Evaluation of The Relationship Between Indoor Radon And Geology, Topography And Aeroradioactivity

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at George Mason University

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Spring Semester 2009
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Dedication

This is dedicated to the loving memory of my mother, Mampaye Vonyee Siaway, my grandmother, Kweewotaye Gorloan Siaway, my son, George Siaway, and my loving daughter, Patricia Siaway.

Acknowledgements

I would like to thank my friends, relatives, and supporters who have made this happen. My loving daughter, Patricia, inspired me to persevere. Dr. Douglas Mose and the other members of my Dissertation Committee were of invaluable help.

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Abstract

EVALUATION OF THE RELATIONSHIP BETWEEN INDOOR RADON AND GEOLOGY, TOPOGRAPHY AND AERORADIOACTIVITY

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George Mason University, 2009

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It would be extremely useful to determine if, on a county-size scale, there might be some predictability to indoor radon. One approach is to make an application of GIS and 3D visualization to explore the radon problem in Fairfax County, to evaluate spatial autocorrelations between indoor radon and geology, elevation, slope, and aeroradioactivity. It was found that there is a tendency for indoor radon to be greater in some parts of Fairfax County in homes on some geological units, in homes constructed on lower slopes, on sites at lower elevations, and in areas of higher aeroradioactivity. However, none of these physical variables exhibits a strong enough control on indoor radon to be used to construct radon potential maps that carry a high confidence of accuracy.

I. INTRODUCTION

Exposure to natural sources of radon has become a significant issue in terms of radiological protection. Moreover, it is generally recognized that significant amounts of the radioactive gas, radon, accumulates in some homes in the Appalachian Mountain System (Mose, 1987). The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 2000) reports that nearly half of the total natural background dose received from natural sources can be attributed to inhaling radon and its progenies present in dwellings. These include Rn^{222} and its short-lived radon decay products (RDPs) Po^{218}, Pb^{214} and Bi^{214}.

Breathing RDPs is known to cause lung cancer (Brookins, 1990). Nationally, 22,000 annual lung cancer deaths per year are attributed to residential exposure to indoor radon (Hendrick, 2003). The United States Environmental Protection Agency (USEPA) and others have shown that lung cancers are caused by two of the RDPs, ^{218}Po and ^{214}Po, which produce very energetic alpha particles (Cohen, 1987 BEIR IV, 1988; Nazaroff and Nero, 1988; Momcilovic and Lykken, 2007). In general, homes with more radon have more RDPs. Studies have demonstrated that elevated levels of indoor radon lead to increased lung cancer (Clarke and Southwood, 1989; Green et al., 1992; Bochicchio et al., 2005; Luthi et al., 2006; Catelinois, 2007; Smith and Cowles, 2007), and other epidemiological studies have suggested that exposure to radon might contribute to the development of several other forms of cancer, including certain childhood cancers (Henshaw et al., 1990; Field, 2001; Bochicchio et al., 2005; ALA, 2006; Darby, 2006; Luthi et al., 2006; Riesenfeld et al., 2007; Leuraud et al., 2007; Villeneuve et al., 2007; Catelinois, 2007). Because exposure to radon gas in buildings is a likely risk factor for lung cancer, estimation of residential radon levels is an important public health endeavor (Smith and Cowles, 2007).

The USEPA recommends that when a home is purchased, it should have a Rn^{222} concentration of less than 4 picoCurie per liter (pCi/L), and for long-term occupancy, the indoor radon concentration should be less than 2 pCi/L. Some studies indicate radon leads to an increase in the risk of developing lung cancer at concentrations even below these official guidelines (Barros-Dios et al., 2002). It is known that indoor radon concentrations vary between adjacent homes, that homes with high indoor radon concentrations have been found in every state in the United States, and that it is not possible to predict indoor radon in any particular home (Smith and Field, 2007). The USEPA position is that every home should be tested, and estimates that RDPs from indoor radon are causing lung cancer in hundreds and perhaps thousands of Virginia residents each year (USEPA, 1993; Peterson, 2006).

The American Association of Radon Scientists and Technologists (AARST) estimates that 10 million homes in America have indoor radon in excess of 4 pCi/L, and this is growing by 75,000 homes per year as new homes are built. Concerns about indoor radon emanation from soil have led to an increased focus on comparisons between radon concentrations in the soil and in dwellings constructed on these soils. Soil-to-indoor comparisons have been made in attempts to create radon potential maps, as comparisons with epidemiological data. These maps seek to reduce the lung cancer hazard by alerting concerned homeowners. Some radon potential maps show that very high indoor radon concentrations may be correlated with uranium found in soil over uranium enriched crystalline rock units or over locally fissured rocks (Oliver and Kharyat, 1999; Swako et al., 2004; Krivoruchko, 2001; Mose et al., 2006b), but usually the high radon homes are simply over soils that have higher uranium and higher permeability. To make these determinations, comparisons with the spatial variation of indoor radon are essential (Oliver et al., 1992; Lacan et al., 2006).

The primary goal of the following study was to evaluate the radon risk potential of all of Fairfax County in northern Virginia. Some areas in the County have little radon measurement data, so this study sought to predict indoor radon in these areas where few radon measurements now exist. This was done by evaluating areas that have many radon measurements. Risk was evaluated using geological maps, slope and elevation data, and aeroradioactivity.

I.1. Indoor Radon as an International Problem

Radon is both a national and an international environmental health problem. Elevated radon levels have been found in all states as well as outside of the United States. Studies in North America and Europe suggest long-term radon exposure at concentrations found in many homes increases lung cancer risk (Luthi et al., 2006; Darby, 2006; Riesenfeld et al., 2007; Leuraud et al., 2007; Catelinois, 2007). The World Health Organization (WHO) estimates radon causes between 6% and 15% of lung cancers worldwide (ALA, 2006). Luthi et al. (2006) suggested that indoor concentration of radon is responsible for 8% of lung cancer cases in Switzerland. Similar studies have associated exposure to indoor radon with lung cancers in Europe (Darby, 2006), in the Mediterranean Region (Bochicchio et al., 2005), in France (Catelinois, 2007), and in Newfoundland (Villeneuve et al., 2007). These studies show appreciable hazards from residential radon, particularly for smokers and recent ex-smokers, and indicate that residential radon is responsible for approximately 2% of all deaths from cancer in Europe (Darby, 2006). The global health concern for exposure to indoor radon is demonstrated by recent studies that seek to quantify residential radon at regional levels, such as population-weighted averages of 0.2 pCi/L for indoor radon in Egypt, 0.5 pCi/L in the UK, 1.2 pCi/L in the US, 2.9 pCi/L in Sweden, and 3.8 pCi/L in the Czech Republic (Appleton, 2007).

I.2. Causes of Indoor Radon

Studies at the regional level have associated residential radon exposure with increased incidence of lung cancer in Vermont (Riesenfeld et al., 2007), in Iowa (Field et al., 2000; Shi et al., 2006), in Virginia (Peterson, 2006), and in North Dakota (Momcilovic and Lykken, 2007). Some regional studies have addressed the temporal variation of indoor radon (Denman et al., 2007; McNeary and Baskaran, 2007; Magalhaes et al., 2003). Others have addressed the decreased health risk obtained from using new radon reduction methods (Kitto, 2007), evaluated the variation of seasonal indoor radon related to precipitation (Mose et al., 2006), assessed the association between some geological units and indoor radon (Mose et al., 2006; Siaway et al., 2006), and assessed the association between indoor radon and surficial gamma radiation (Brown et al., 2005).

Many recent studies have successfully quantified radon levels in dwellings (Al-Jarallah, 2006; Mahur et al., 2006; Ioannides et al., 2000). Others have focused on the spatial distribution of residential radon (Franco-Marina et al., 2003; Lacan et al., 2006; Buttafuoco et al., 2007), on the exhalation rates of radon levels in prevailing building materials (de Jong and van der Graaf, 2006), on quantifying seasonal variations and depth dependence of soil radon concentration levels in different geological formations (Al-Shereideh, 2006; Lu and Zhang, 2006; Brown et al., 2005; Magalhaes et al., 2003), on quantifying the amount of natural radioactivity in building materials (Ahmad, 2007), on evaluating radon emanation from soil gas (Malczewski and Zaba, 2007; Zunic et al., 2006), on assessing factors that underlie radon emission (Barros-Dios et al., 2007), on evaluating radon concentrations in soil and groundwater (Mose et al., 2006), on evaluating seasonal indoor radon variations related to precipitation (Mose, et al., 2006), and on assessing differences in indoor radon emanation due to soil chemistry, home heating systems and precipitation (Siaway et al., 2006; McNeary and Baskaran, 2007).

Recent studies conducted in northern Virginia showed that there are a considerable number of homes in which indoor radon exceeds the USEPA action level (4 pCi/L), and that lung cancer is the second leading cause of mortality in Virginia (Peterson, 2006). This makes a compelling case for evaluating the spatial distribution of indoor radon in Fairfax County, Virginia.

II. RESEARCH OVERVIEW

One of the hallmarks of epidemiological analyses is the thought that health problems in a population can be better understood if the spatial frequency and distribution of the health problems are compared to spatial variations of the cause(s) of the health problems. However, for most states there is little potential for determining the spatial variation of indoor radon or soil radon (Oliver and Kharyat, 1999). The exception is northern Virginia, where thousands of precisely located indoor radon measurements have been compiled for a small but geologically diverse terrain (Mose, 2005).

Geostatistical techniques are commonly used nowadays to map a range of environmental variables, particularly to generate probability maps of exceeding a given threshold value. However, very few case studies in which indoor radon measurements have been investigated using geostatistical techniques have been published (Dubois et al., 2007). Geotechnical data are sufficiently accurate in Virginia to make radon potential maps. For example, it has been suggested that some soils above some geologic units in northern Virginia may be associated with elevated indoor radon concentrations in homes built on these soils (Mose and Mushrush, 1997b; Mose and Mushrush, 1999; Mose, 2006; Siaway et al., 2006; Mose et al., 2006b; Brown et al., 2005). This was based on apparent correlations of uranium content, permeability and radon, and the presence of some soils, which could be good indicators for homes with radon.

The microtopographic location of a home may also be important. That is, it seems likely that homes constructed on hilltops and hillsides will tend to have more indoor radon because their soils are more permeable, allowing greater movement of radon in soil gas (Mose, 2006; Siaway et al., 2006).

Appleton (2007) suggested that on-the-ground direct sampling of soil (as opposed to airplane measured radioactivity) in order to make radioactivity measurements could be used to predict indoor radon and soil radioactivity over a large area. However, on-the-ground sampling of soil and making radioactivity measurements of each sample is expensive, so the measurements are often not numerous. Aerial radiometric data have been used to quickly quantify the radioactivity of large areas of rocks and soils (Schumann, 1995; Appleton, 2007). Uranium and radon soil measurements are estimated by measuring the gamma-ray emission of Bi^{214}, a RDP of radon. Consequently, it seems reasonable that an aeroradioactivity map could be a good indicator for homes with radon.

II.1. Description of the Fairfax County Database

Fairfax County in Virginia is a diverse and thriving urban county. As the most populous jurisdiction in both Virginia and the Washington metropolitan area, the population of the county exceeds that of seven states (Figure 1). The median household income of Fairfax County is one of the highest in the nation and over half of its adult residents have four-year college degrees or more educational attainment. The land area of Fairfax County is 252,828 acres with an estimated 2005 population of 1,041,200 (U.S. Census Bureau, 2000). Many new homes, most without a pre-occupancy radon test, are constructed each year.

Figure 2 presents the location of the homes from which indoor radon measurements were obtained for this study. Over 1,000 homes were tested for indoor radon in winter, spring, summer and fall (see Appendices 1 and 2). The vertical line above each location in Figure 2 represents the concentration of indoor radon at that location. Each color represents concentration of indoor radon at that location. For example, in Figure 2, vertical blue lines represent homes with indoor radon of more than 12 pCi/L.

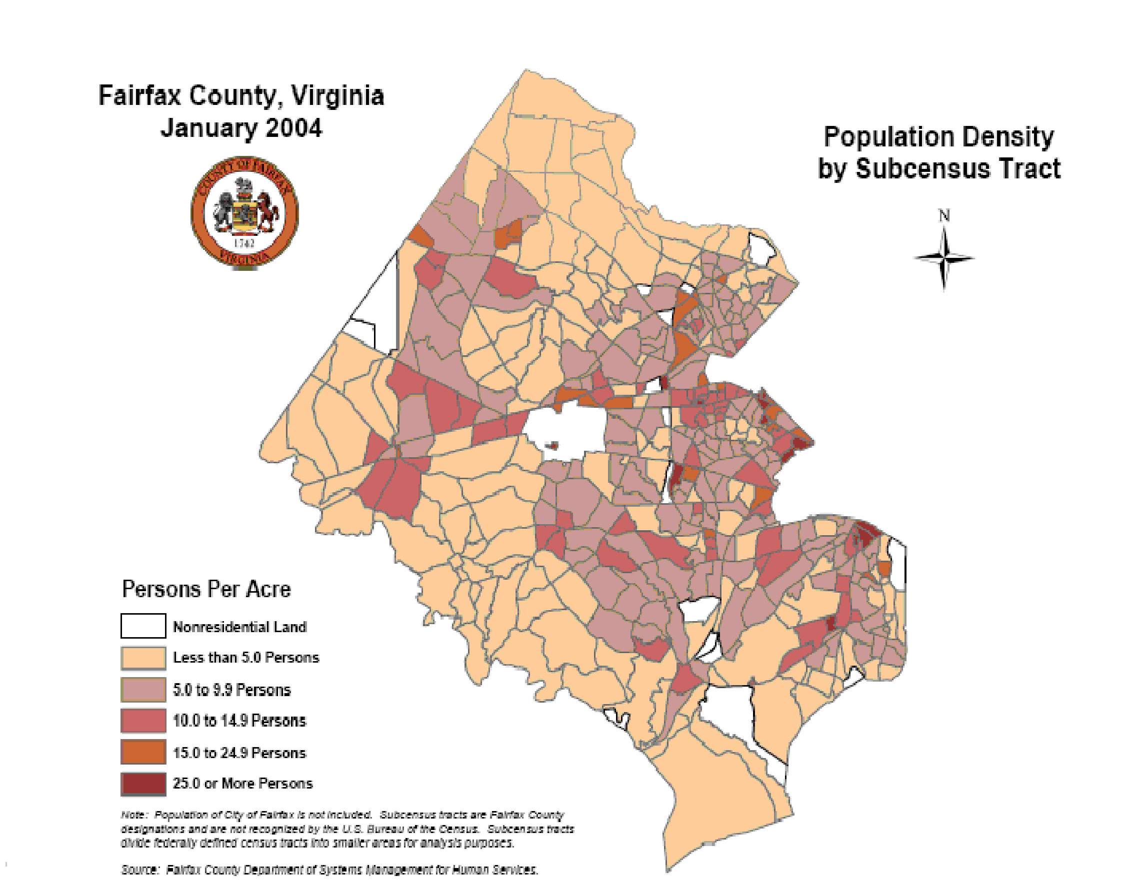


Figure 1: Population Density of Fairfax County

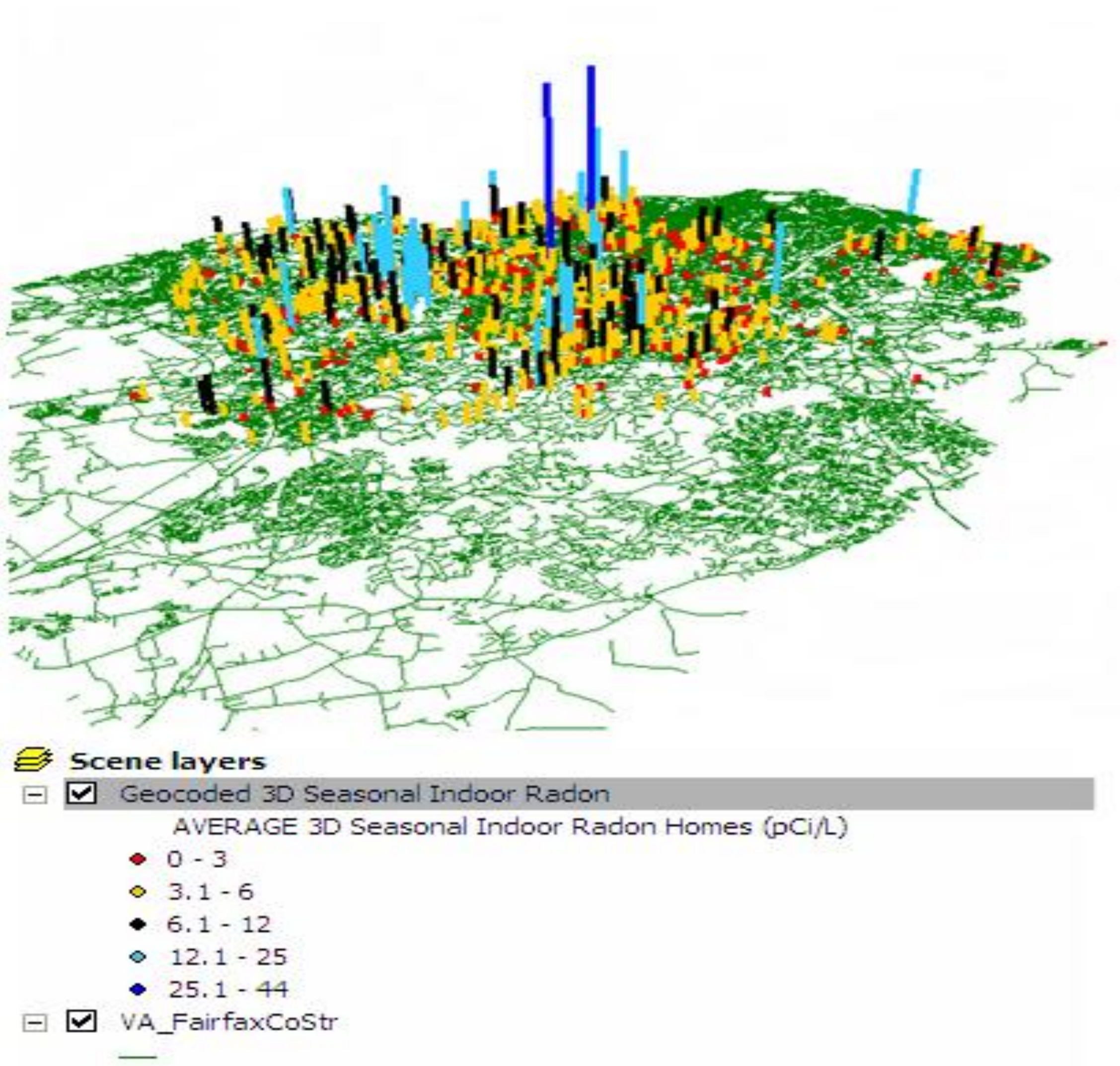


Figure 2: Location of Indoor Radon Homes – Fairfax County, Virginia

II.2. Trends in the Comparison of Indoor Radon and Home Location, without Geotechnical Considerations

The measurements of over 1,000 homes available for this study were first examined to see if they exhibit a non-homogeneous pattern. If they do, this pattern could possibly be related to known non-homogeneous geotechnical parameters, such as the distribution of geological units, the slope under homes, the elevation of homesites, and the distribution of high- and low-aeroradioactivity soils. The variation in indoor radon was visually examined, and from this examination a non-homogeneous pattern appeared likely, so a hypothesis was advanced that radon in the northwest part of Fairfax County is higher than radon in the southeast. To evaluate this hypothesis, indoor radon data were subjected to a directional distribution analysis (i.e., standard deviational ellipse and trend tools).

In a GIS, every line is assigned a start point and an end, and thus has a direction (Mitchell, 2005). The direction is set by digitizing or by using coordinates. The line can be a representation of a real-world object like the amount of indoor radon in a home. In a study of indoor radon measurements, the measurements can be shown as vertical lines of different lengths rising off a map. The tips of the lines form a surface, and a GIS study can measure a trend on this surface by a “standard deviational ellipse.” The trend analysis tools are embedded in the method of a geostatistical analysis and ArcGIS. ArcGIS is the newest GIS technology from Environmental Science Research Institute (ESRI) that is used for mapmaking, displaying and querying maps, spatial analysis, and database creation.

II.3. Directional Trend Analysis

A standard deviational ellipse was determined to describe the distribution of the indoor radon measurements in homes in northern Virginia. It measures the distribution of data values around the statistical mean. The ellipse method allows one to see if the distribution of indoor radon measurements is not uniform throughout Fairfax County, but instead, if contoured as in topographic mapping, has a particular orientation. A trend analysis using a standard deviational ellipse can calculate the standard deviation of the x-coordinates and y-coordinates that describe its shape from the center of the ellipse. Definitions of geostatistical terms are shown in Appendix 3.

A trend analysis provides a three-dimensional perspective of the data. In the case of a radon study, home locations are plotted on the x, y plane. Above each home location, the indoor radon measurement is given by the height of a “stick” in the z dimension. In this fashion, new data are created, which are points above a plot of the study site, at a height of the z values. The tops of the "sticks" are then projected onto the x, z plane and the y, z plane, forming scatter plots.

Figure 3 presents the distribution and magnitude of winter indoor radon in these homes. The x and y directions, while perpendicular to one another, can be in any compass direction. The x – z and y – z projections are fit with a polynomial curve for each projection. If the curve through the projected points is flat (horizontal line), no trend exists. If the curve through the projected points is not flat, it suggests a trend in the data.

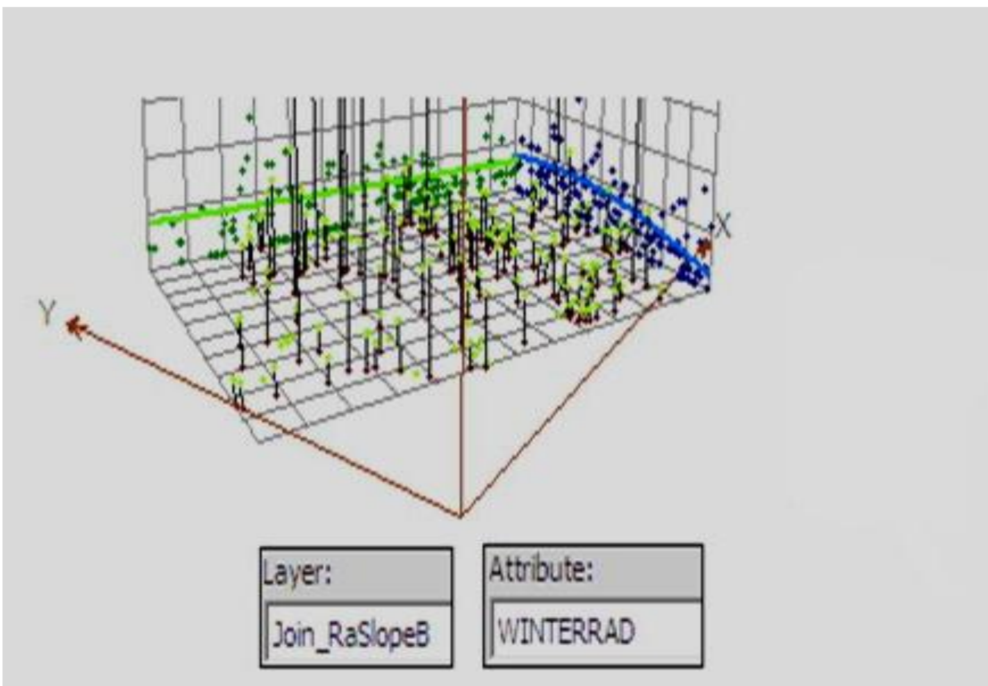


Figure 3: Global Trends of Seasonal Indoor Radon Homes

The blue line in Figure 3 represents the north to south direction and by its direction shows that indoor radon generally decreases from the north to the south. The blue line is an arc, which shows less radon in the north, more radon in the middle and less radon towards the south. The green line represents the east to west direction in Figure 3. By its direction and slope it shows that indoor radon generally increases from the east to west. In this fashion, the standard deviational ellipse also referred to as the "directional distribution", measures whether a distribution of features exhibits a directional trend Figure 4).

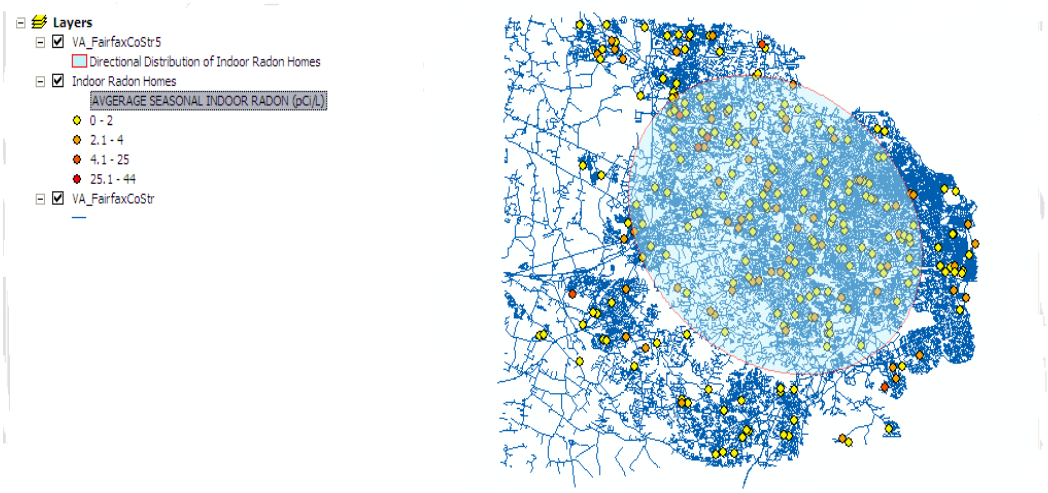


Figure 4: Directional Distribution of Indoor Winter Radon and Location Using a Standard Deviational Ellipse

II.4. Spatial Autocorrelation

Spatial autocorrelation is a method that can be used to measure the magnitude of trends. Spatial autocorrelation can show the extent to which the value of one attribute (i.e., indoor radon measurements) changes when the value of another attribute (i.e., slope, elevation) changes. If we can correctly identify some attribute that influences indoor radon, we might get a better understanding of how to predict indoor radon. This might be done by using the null hypothesis method for spatial autocorrelation analysis. For example, we can use a null hypothesis which states that comparisons we can measure (i.e., radon verses slope, elevation and aeroradioactivity) occur randomly across the study area. Obviously, we hope to find that higher radon is associated with higher values of slope, elevation or aeroradioactivity, and that this null hypothesis is not correct.

Moran's I is a statistic used to determine the autocorrelation of the data. Moran's I is a weighted correlation coefficient that can be used to detect departures from spatial randomness in local concentrations of data (Anselin, 1995). A "concentration of data" is a grouping of data that have similar low or high values (i.e., a clustering of similar indoor radon measurements). The GIS first calculates the mean value for the seasonal indoor radon measurements that are being analyzed, then calculates the difference from the mean for adjacent radon values and multiplies it by a "weight" for that adjacent radon measurement. That is, the Moran's I compares the value for a point with the mean and then compares the point's neighbors with the mean. Weighting involves giving a higher value to features such as particular indoor radon measurements with adjacent similar indoor radon measurements. This means that indoor radon measurements near the edge of a study area, where there are fewer adjacent indoor radon measurements, are likely to have a lower "weight" for Moran's I. Expanding the study area to include more radon measurements would possibly result in more clusters of values. Mitchell (2005) gives a detailed description of how Moran's I is generated and how it aids in the determination of the concentration or dispersal of variables.

Moran's I allows for the detection of clusters and quantifies the extent to which clusters are clustered. As noted earlier, a cluster refers to a grouping of similar indoor radon at homesites that are close together. A "cluster of clusters" could come from a study area which has clusters of radon measurements, and many similar clusters occur near each other. Departures from randomness happen when clusters have geographic trends. For instance, if we are studying the distribution patterns for indoor radon at homesites, groups of similar clusters ("clustering of clusters") in the distribution pattern occur when there is some broad area that has higher than average seasonal indoor radon and some other area with lower than average radon. This is called a positive spatial autocorrelation. That is, positive spatial autocorrelation has all similar radon values appearing together, while negative spatial autocorrelation has dissimilar radon values appearing in close association.

The Moran's I function also calculates a “z score” value that indicates whether the amount of clustering of radon measurements could be the result of random chance or is statistically significant. The z score is a test of statistical significance that helps decide whether or not to reject the null hypothesis. If the null hypothesis states that there is no pattern, the expected pattern is one of hypothetical random chance.

To summarize, what is being measured is the likelihood that the similarity between radon measurements is not due simply to chance. This is done by calculating a z score which tells the likelihood of being wrong to reject a null hypothesis that says the pattern is random. A very high positive z score for a radon measurement indicates the surrounding measurements have similar values. A very negative z score for a radon measurement indicates that the feature is surrounded by dissimilar values. To determine if the z score is statistically significant, it is compared to a range of values for a given confidence level. For example, the critical values for z-scores when using a 95% confidence interval are -1.96 and +1.96 standard deviations. So, if the z-score is somewhere between -1.96 and +1.96, the null hypothesis (the random chance hypothesis) cannot be rejected. Similarly, at a confidence level of 99%, a z-score would have to be less than -2.58 or greater than +2.58 to be statistically significant. When the z-score falls outside that range and is a very low or very high score (like -3.58 or +3.58), this shows a pattern that is too unusual to be a pattern of random chance. So we can reject the null hypothesis, and perhaps we can figure out what spatial process might be causing that either a clustered or a dispersed pattern.

The output for the spatial autocorrelation analysis is a graphical display (e.g., Figure 5) that presents the results in 4 different ways. It begins at the top by giving the statistical numbers that include Moran’s I and the associated z-score. Under that is a pictorial representation of what those statistical numbers describe. The picture illustrates the pattern, which could be clustered, random, or dispersed. Located under the picture is a bar graph that shows if the results are statistically significant. Finally, at the bottom of the bar graph is a dialog that presents the results as a sentence.

As shown in Figure 5, the low Moran's I (0.04), reveals the presence of clusters of winter radon values that are high or low. The z-score of 3.75 standard deviations falls outside the critical value (-2.58 and +2.58 standard deviations). This means that at the 0.01 confidence level, we are 99 percent certain the clustered distribution pattern for indoor radon at homesites could not be the result of random chance. This means there is less than one percent likelihood that the cluster pattern could be the result of a random chance. Said another way, based on the pattern of winter indoor radon measurements, we can reject the null hypothesis that winter indoor radon measurements are evenly distributed and have a random pattern across the study area. A similar conclusion was found for the spring and fall indoor radon measurements.

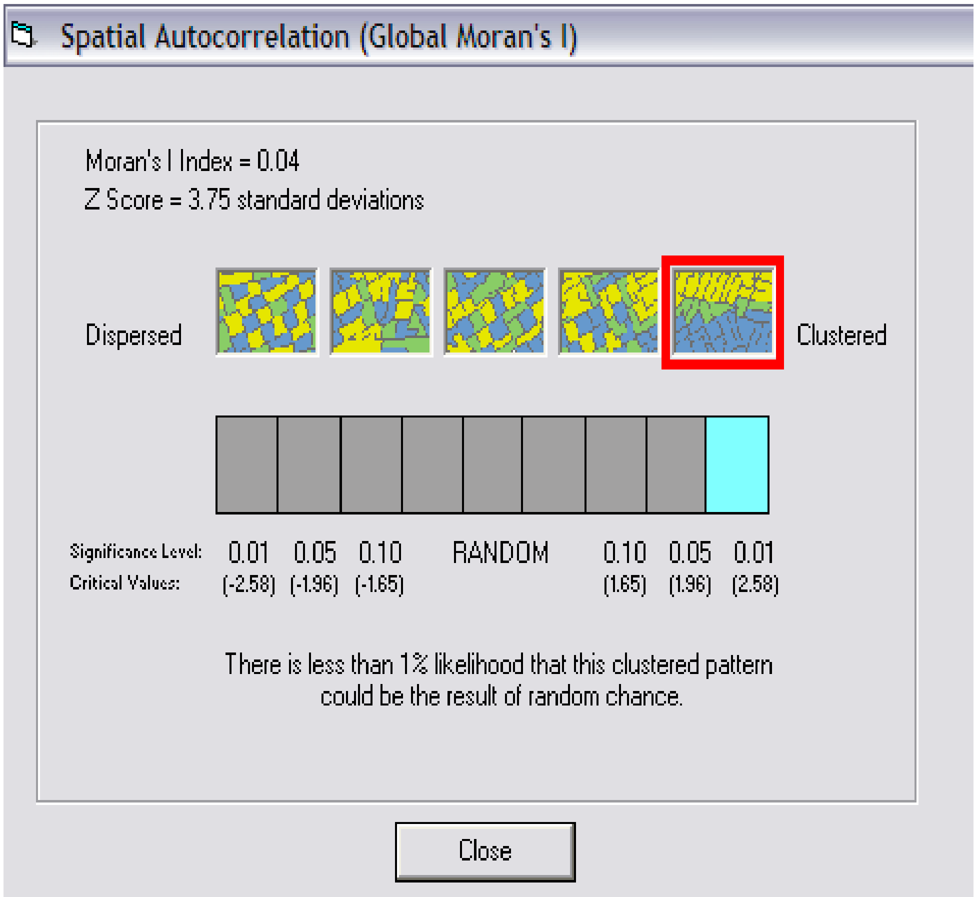


Figure 5: Spatial Autocorrelation Analysis of Winter Indoor Radon

A study of all the seasons showed that while the winter, spring and fall patterns are similar, the distribution pattern for summer radon differs from that of the other seasons, so the results of a study of the spatial autocorrelation of the summer pattern are presented in Figure 6. Evidently, the summer radon pattern is neither clustered nor dispersed (i.e., it is random). The low Moran's I (0.01) is due to the presence of similar summer radon values that are high or low. The z-score of 1.5 standard deviations falls inside (not outside as in Figure 5) the critical values (-1.65 and +1.65 standard deviations). This means that at the 0.1 confidence level, we are 99 percent certain the “neither clustered nor dispersed pattern” for indoor summer radon at homesites could (not could not as in Figure 5) be the result of random chance. This means that there is less than one percent likelihood that the “neither clustered nor dispersed pattern” could not be the result of a random chance. Said another way, based on the pattern of summer radon measurements, we cannot reject the null hypothesis that summer radon measurements are evenly distributed and have a random pattern across the study area.

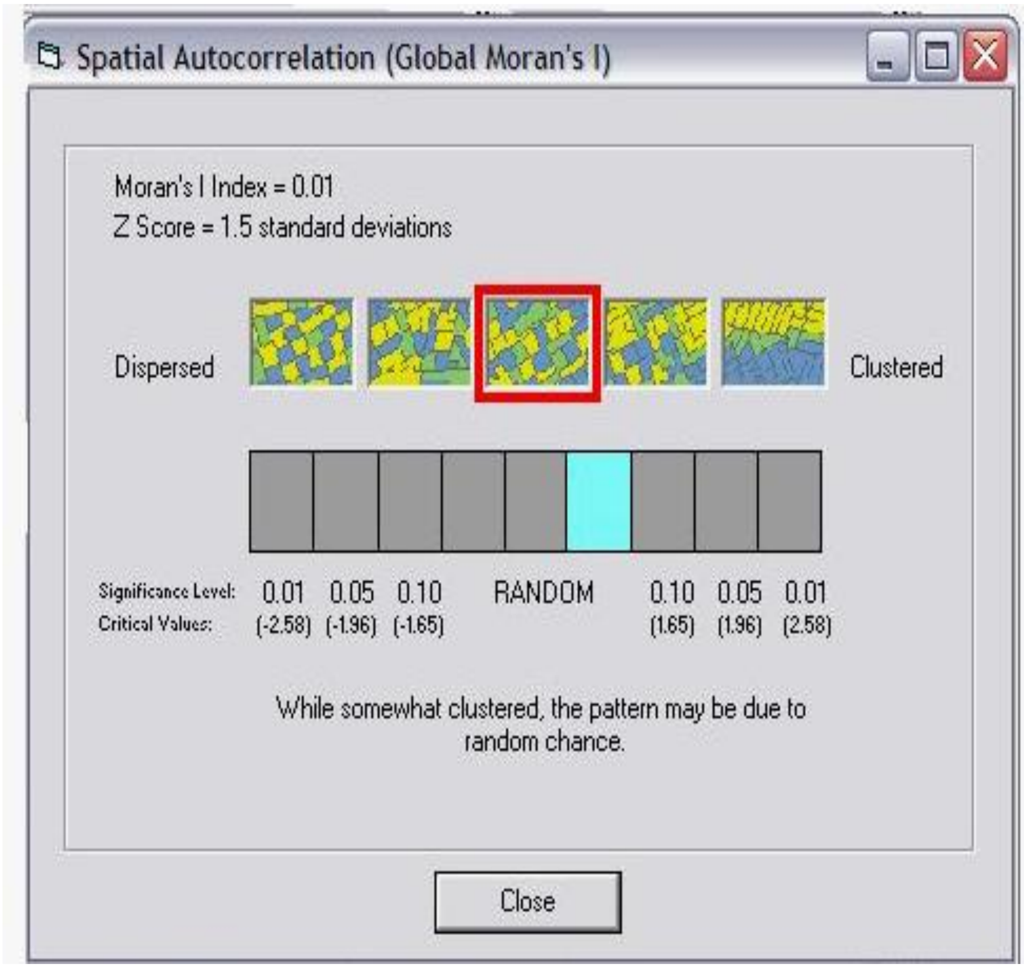


Figure 6: Spatial Autocorrelation Analysis of Summer Indoor Radon

It is possible that this "neither clustered nor dispersed" pattern could simply be a random pattern due to a combination of natural phenomena. However, it might be due to a few incorrect summer indoor radon measurements, which produce areas with dissimilar summer indoor radon values that are near to each other. It would require an additional study to resolve this question.

II.5. Summary of Directional Trend Analysis and Spatial Autocorrelation of Indoor Radon and Location

Figure 3 presented the north to south and east to west directional trends for winter indoor radon in homes. Figure 4 showed that the distribution of similar radon measurements is elliptical and, hence, has a particular orientation. Figure 5 presented the spatial autocorrelation analysis results for winter indoor radon in homes, which showed a clustered pattern. There is less than 1% likelihood that the clustered pattern could be the result of random chance (spring and fall indoor radon measurements show a similar pattern).

We infer that some cause exists for this trend. For the predictive maps we seek, we hope that indoor radon emanation is dependent on the available well documented geotechnical factors, which are geology, slope, elevation and aeroradioactivity.

III. INDOOR RADON VERSUS GEOLOGY IN FAIRFAX COUNTY

The next goal of the research was to compare, by using GIS, the distribution patterns of indoor radon and geotechnical indicators, the first of which is geology. In nature, some rocks found in some geological units and the soils produced over these rocks are richer than others in uranium, which produces radon. Similarly, the soils of some types of rocks are more permeable (more sandy) and allow more rapid radon movement through soil and facilitate greater entry into homes. Therefore, it was hypothesized that the homes constructed over some geological units would have significantly higher indoor radon than homes over other units.

Most of the rock units present in Fairfax County are also found in counties north and south of this area, and very similar rock units are found from Maine to Georgia. Figure 7 shows the simple and commonly seen map used to illustrate the geology of Fairfax County. Fortunately, a more precise and detailed and digitized map (Figure 8) has been created for Fairfax County (VDMME, 1993). While too complex for easy study, this newer digitized geologic map (Figure 8) was used because the precise locations of homes could be placed on this map. Descriptions of the geologic units are in Appendix 4. Table 1 presents a comparison of the geological units.

Table 1: Comparison of Geologic Units in Fairfax County, Virginia

Geo-graphic Region	Figure 7	Figure 7A Explanation	Figure 8	Figure 8 Explanation	Tested Homes
Coastal Plain	Unit 10	Sedimentary strata	Kp	Potomac Formation	42
Coastal Plain	Unit 10		Mg	Greenbrier Limestone	1
Coastal Plain	Unit 10		Msg	Miocene Sand and Gravel	13
Coastal Plain	Unit 10		Psg	Pliocene sand and gravel	20
Coastal Plain	Unit 10		Qsh	Shirley Formation	14
Coastal Plain	Unit 10		Qc	Chuckatuck Formation	0
Coastal Plain	Unit 10		Qtu	Quaternary and Tertiary deposits, un-differentiated	1
Coastal Plain	Unit 10		Qcc	Charles City Formation	0
Coastal Plain	Unit 10		Tb1	Bacons Castle Formation	1
Coastal Plain	Unit 10		al	Alluvium	2
Piedmont Terrane	Unit 7A	Falls Church Tonalite and other tonalite	of	Falls Church Intrusive Suite	34
Piedmont Terrane	Unit 7B	Occoquan Granite	O[o	Occoquan Granite	85

Geo-graphic Region	Figure 7	Figure 7A Explanation	Figure 8	Figure 8 Explanation	Tested Homes
Piedmont Terrane	Unit 6	Pope's Head Formation	O[po	Popes Head Formation	135
Piedmont Terrane	Unit 6	Pope's Head Formation	O[ps	Station Hills Formation	26
Piedmont Terrane	Unit 5	Indian Run Formation	I	Indian Run Formation	58
Piedmont Terrane	Unit 4	Annandale Group-mica schist/metagraywacke	Za	Phyllite and slate	55
Piedmont Terrane	Unit 3	Sykesville Formation	Sv	Sykesville Formation	143
Piedmont Terrane	Unit 2	Peter's Creek Schist	Zmg	Mather Gorge Formation	37
Piedmont Terrane	Unit 2	Mather Gorge Formation	Zms	Mather Gorge Formation	335
Piedmont Terrane	Unit 1	Piney Branch Complex	Zpb	Piney Branch Complex	12
Piedmont Terrane	m	Meta-morphosed mafic rocks	u	Unicoi Formation	0

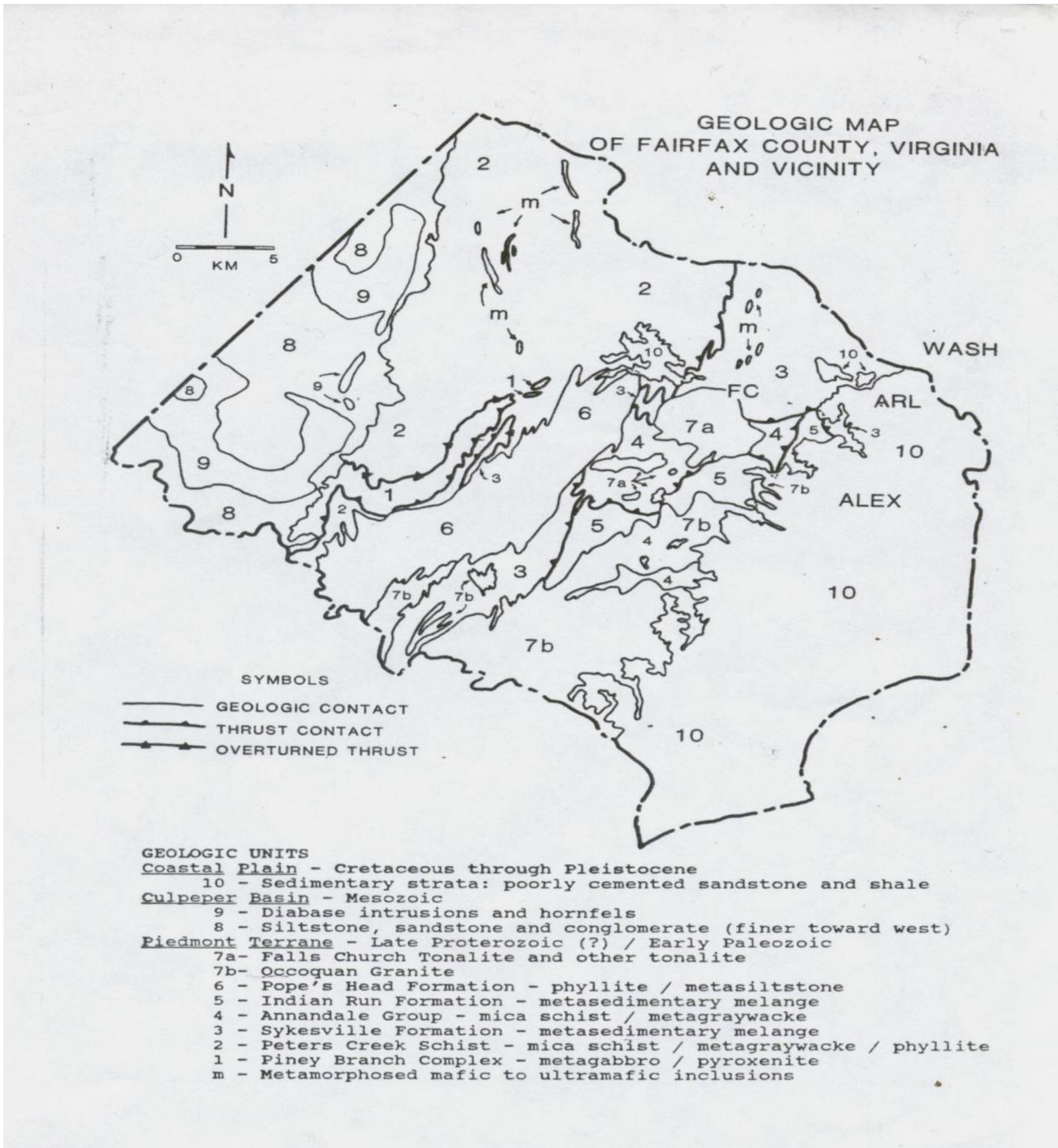


Figure 7: A Simple Geologic Unit Map of Fairfax County, Virginia

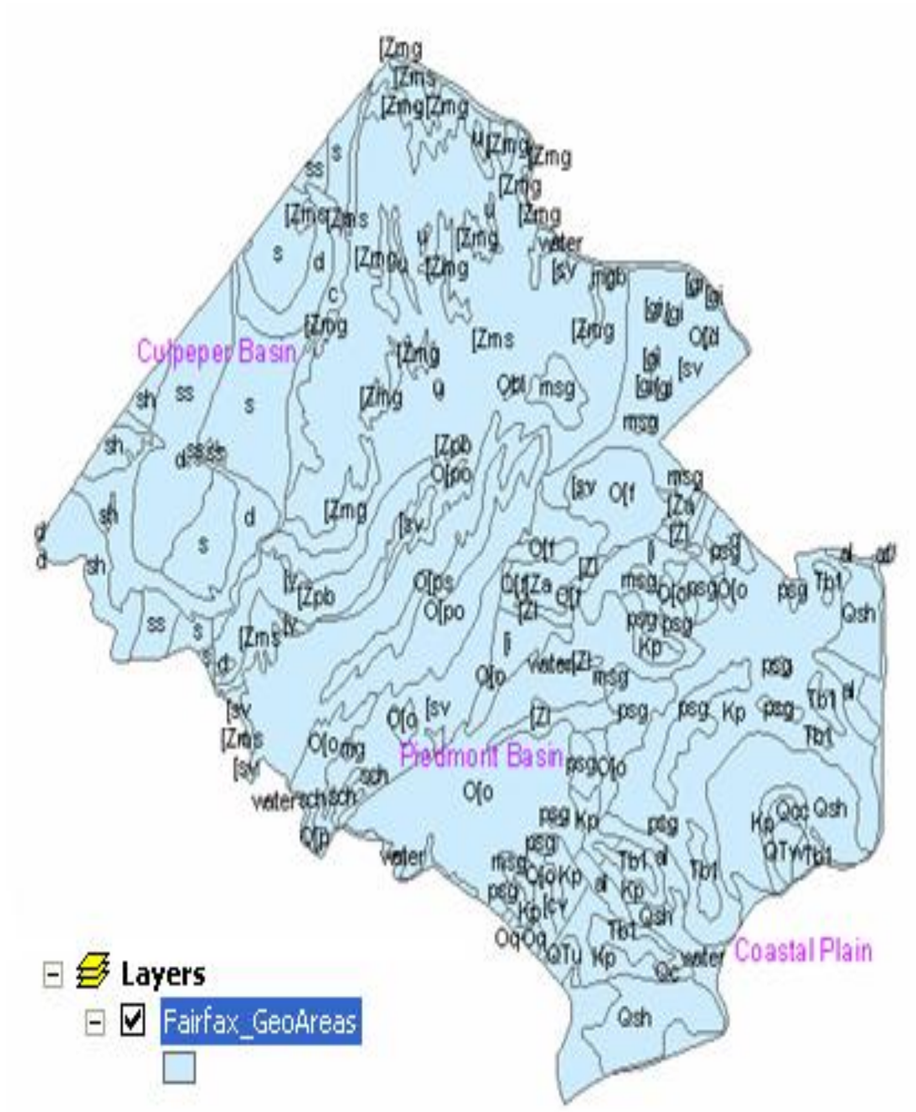


Figure 8: More Precise Geologic Unit Map of Fairfax County

In the eastern part of the study area, the dominant unit in the Coastal Plain is Sedimentary Strata (unit 10 in Figure 7). The Occoquan Granite (7b in Figure 7) constitutes much of the Piedmont Terrane, and it is found where the Coastal Plain sedimentary strata have been removed by erosion, thus exposing the granite. The central part of the study area is called the Piedmont. One widespread metasedimentary rock unit in the Piedmont Terrane is the Sykesville Formation (unit 3 in Figure 7), a metamorphic rock that formed from a small-to-medium grained sedimentary mélange (originally clay and sand layers), with a quartzofeldspathic matrix that contains quartz "eyes" and a heterogeneous suite of pebble-to-boulder and some larger size fragments. Another large Piedmont unit is the Pope's Head Formation (unit 6 in Figure 7), a metamorphosed light-gray to pinkish- and greenish-gray quartzo-feldspathic sandstone, fine-to coarse-grained, pebbly, poorly sorted, commonly thick bedded and trough cross-bedded. A third major unit is the Mather Gorge Formation, which is another metamorphosed sedimentary rock. The other units in the Piedmont (m, l, 2, 4,7a, and in Figure 7) are much less widespread. In the western part of the study area, the Culpeper Basin contains unmetarmophosed sedimentary strata (unit 8 in Figure 7) which were deposited after the metamorphic events that shaped the Piedmont. Also present are volcanic strata and shallow intrusions (unit 9 in Figure 7).

IV. DESCRIPTIVE STATISTICS FOR INDOOR RADON

Once it was shown that during most seasons the distribution of indoor radon measurements was not homogeneous across the study area in northern Virginia (Section II), and it was shown that the area is underlain by a complex distribution of geological units with very different compositions and average indoor radon (Section III), it was reasonable to compare geology (and eventually other non-homogeneous parameters) with indoor radon. The following sections examine the indoor radon measurements in homes built over the geological units with a large number of measured homes. This includes the Sykesville Formation (143 measured homes; Figure 9), the Pope’s Head Formation (135 measured homes; Figure 10), and the Mather Gorge Formation (372 measured homes; Figure 11). Figures 12 – 15 present the seasonal indoor radon measurements in the Sykesville Formation as histograms. Figures 16 – 19 present the Pope's Head Formation histograms, and Figures 20 – 23 present the Mather Gorge Formation histograms.

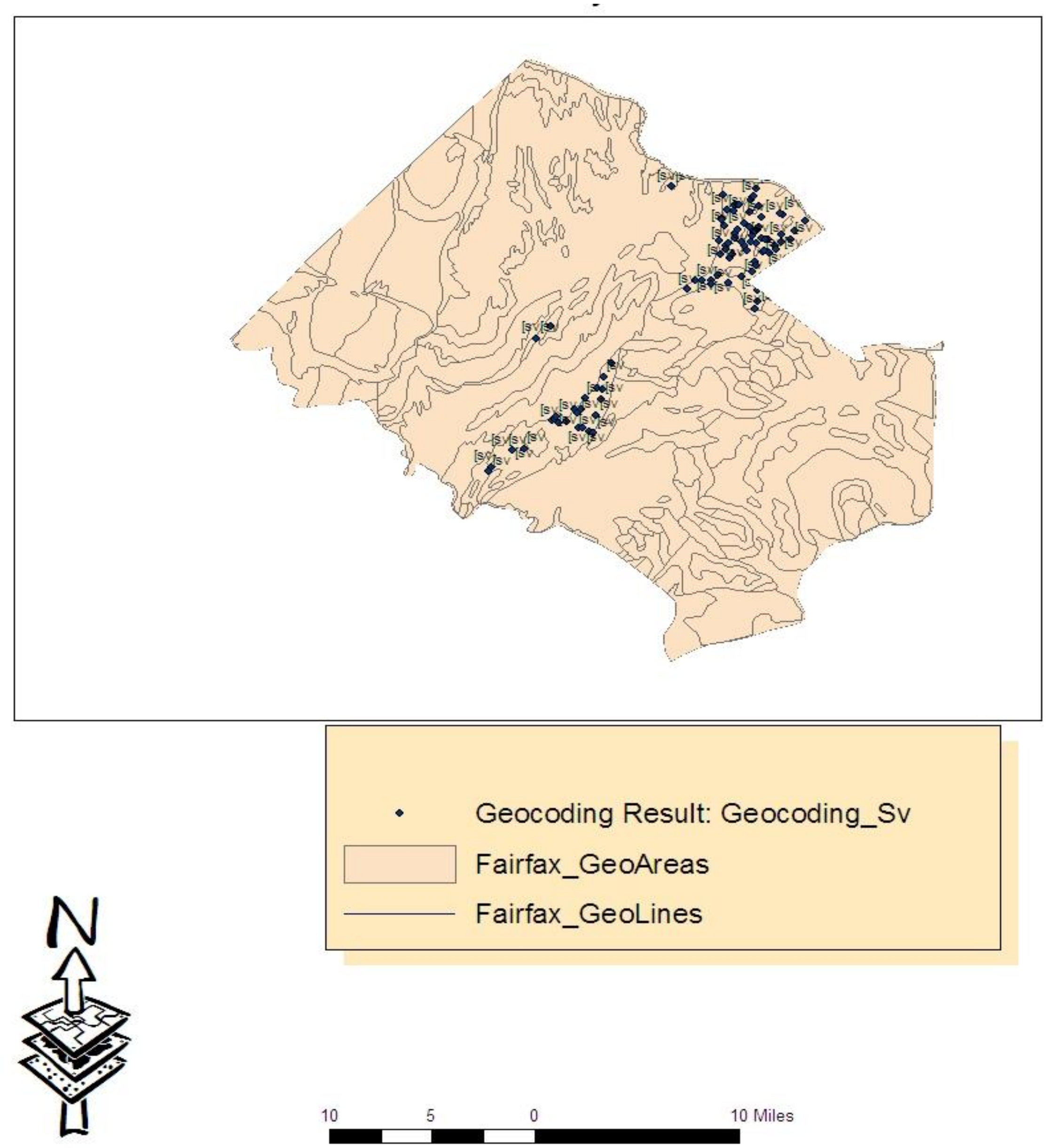


Figure 9: Indoor Radon Homes on the Sykesville Formation

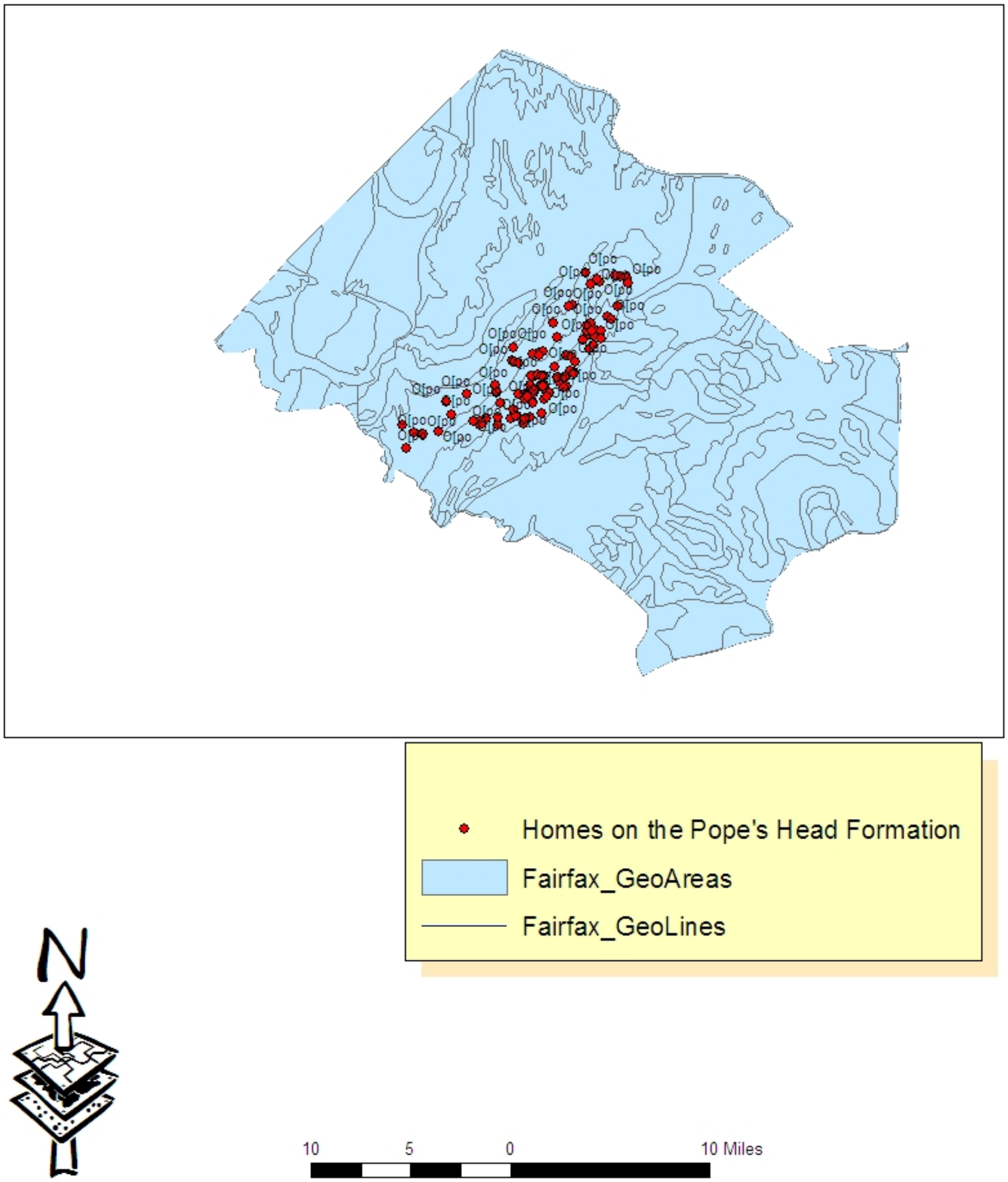


Figure 10: Indoor Radon Homes on the Pope's Head Formation

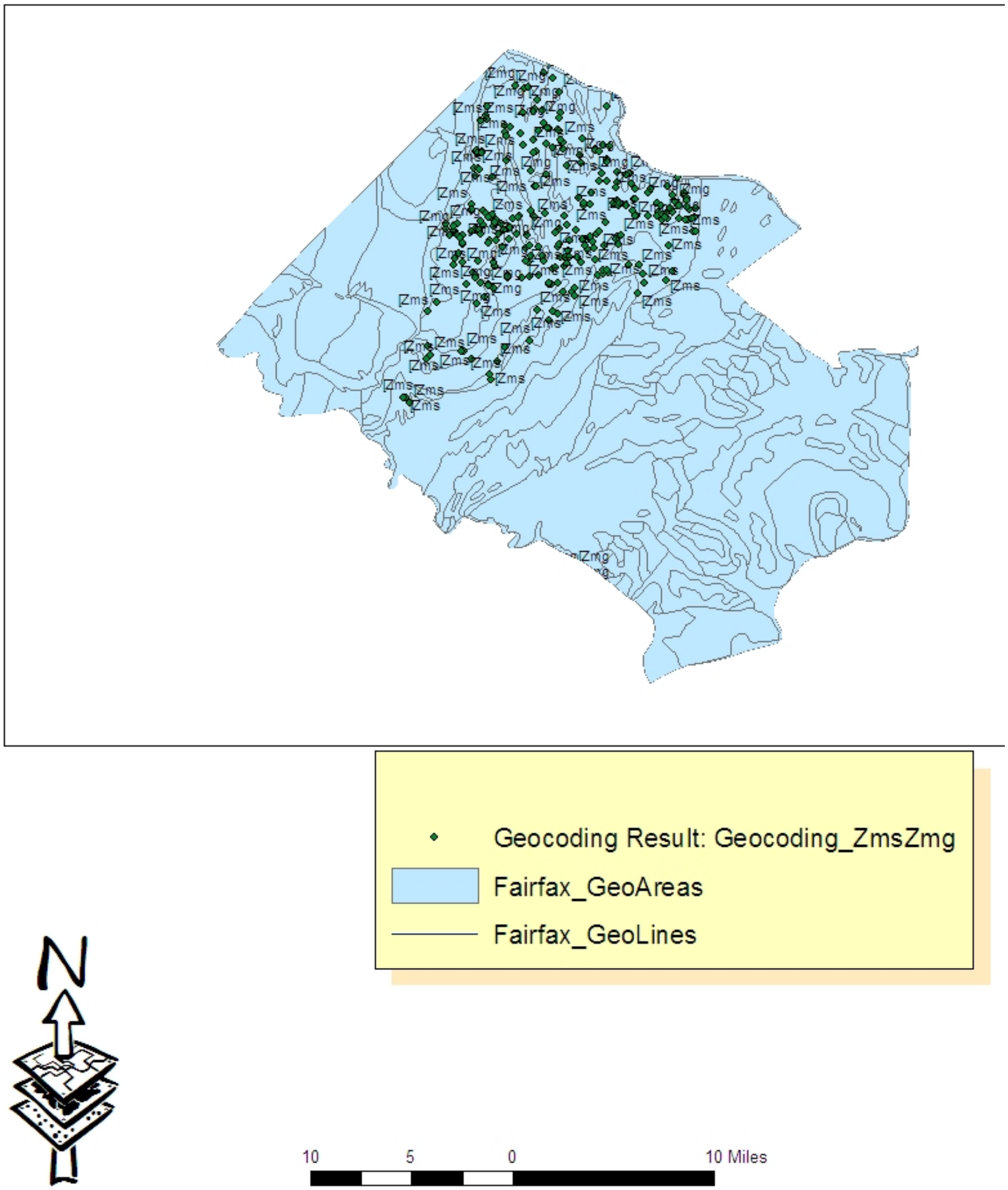


Figure 11: Indoor Radon Homes on the Mather Gorge Formation

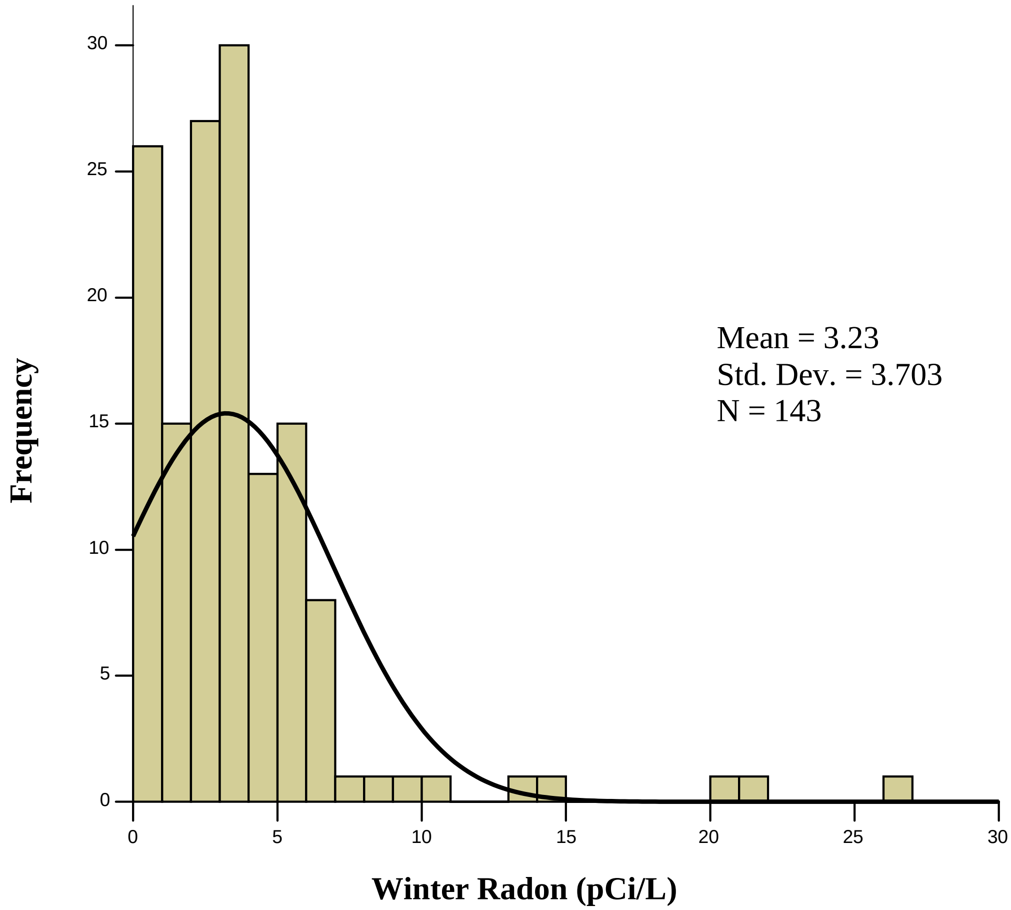


Figure 12: Histogram of Winter Indoor Radon in the Sykesville Formation Homes

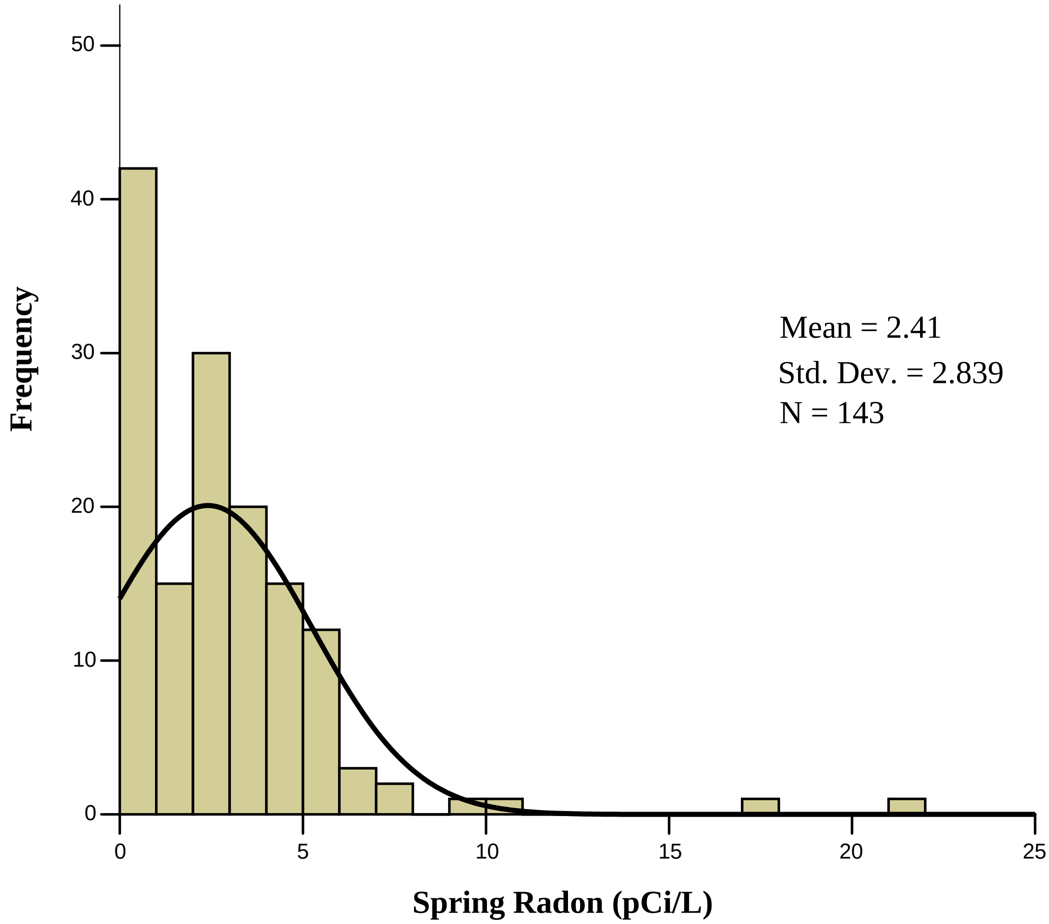


Figure 13: Histogram of Spring Indoor Radon in the Sykesville Formation Homes

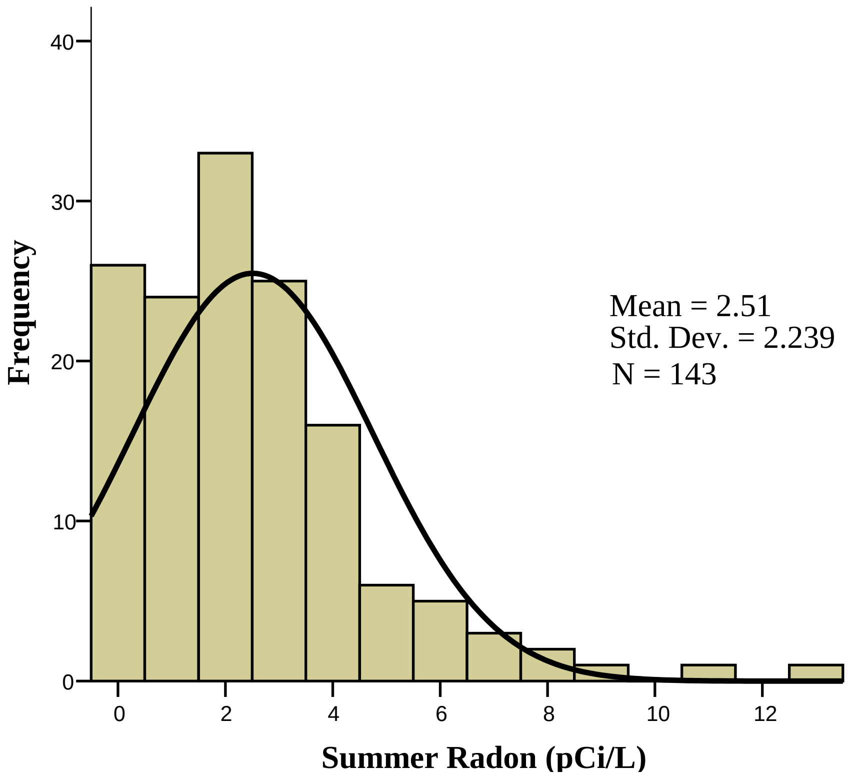


Figure 14: Histogram of Summer Indoor Radon in the Sykesville Formation Homes

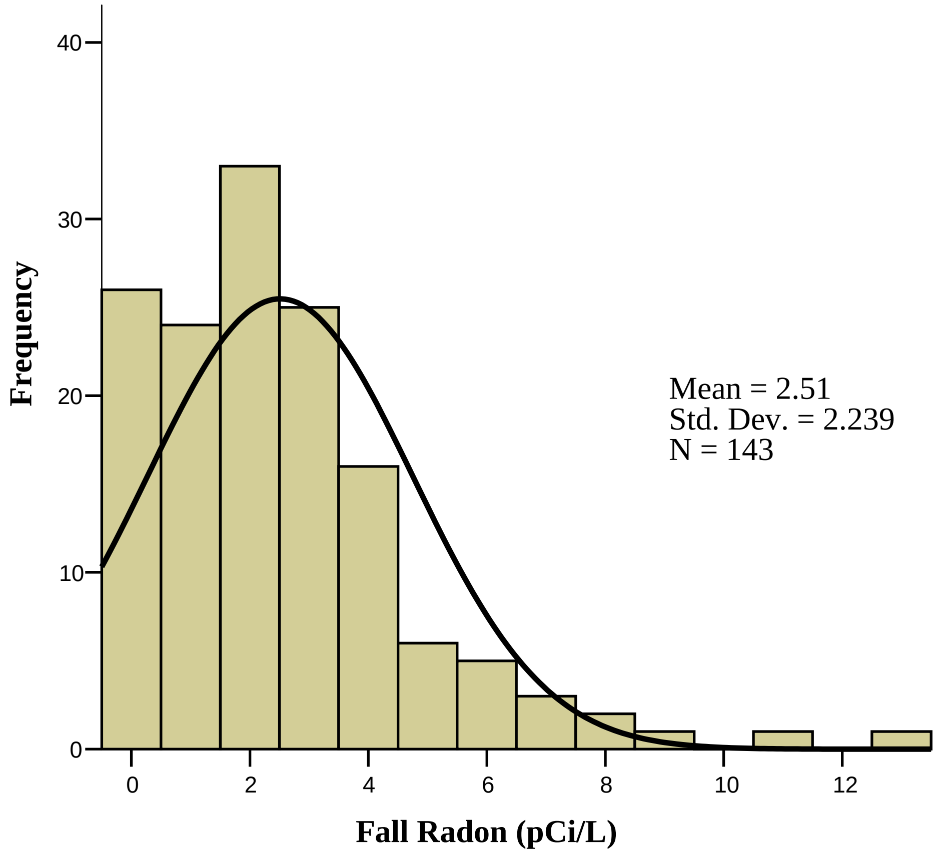


Figure 15: Histogram of Fall Indoor Radon in the Sykesville Formation Homes

IV.1. Indoor Radon and Homes on the Sykesville Formation

Appendix 5 presents the seasonal radon measurements and aeroradioactivity measurements for the Sykesville Formation. Tables 2– 4 present an interpretation of the data from the Sykesville homes:

A. Within the bounds of the standard errors, the mean (average) indoor radon values for the four seasons are close but not identical. Spring and summer values are less than winter and fall (Table 2).

Table 2: Means and the Standard Error of the Means for Seasonal Indoor Radon Measurements over the Sykesville Formation

Season	Mean	Standard Error	Sample Size
Winter	3.2	± 0.3	143
Spring	2.4	± 0.2	143
Summer	2.5	± 0.2	143
Fall	3.0	± 0.2	143

The mean (average) seasonal radon ranges from 2.4 to 3.2 pCi/L. The standard error of each mean is ± 0.2 to ± 0.3. These are small, so if measurements of winter indoor radon in this group of homes had been repeated many times, we would continue to get a winter mean of about 3.2 pCi/L.

A small standard error about the seasonal mean, as shown in Table 2 indicates that for each season the difference between the measured seasonal mean radon values and the expected seasonal mean radon values is small.

B. The 95% confidence interval (lower) and 95% confidence interval (upper) about the means for each season are different (Table 3).

Table 3: 95% Confidence Interval (95% CI) About The Mean for Seasonal Indoor Radon Measurements over the Sykesville Formation

Season	**95% CI (Lower)**	**95% CI (Upper)**	**Size of CI Range**
Winter	2.5	3.8	1.3
Spring	1.9	2.1	0.2
Summer	2.5	2.9	0.4
Fall	2.6	3.4	0.8

The CI gives an indication of how much uncertainty there is in our estimate of the true value. In this interval we are 95% certain contains the true mean. These confidence intervals (CI) are used to indicate the reliability of an estimate. That is, the range between the lower and upper CI's can be used to describe how reliable survey results are. All other things being equal, a survey result with a small CI range is more reliable than a result with a large CI range. The narrower the interval, the more precise is the estimate

(Di Stefano, 2004). Table 3 shows that the spring, summer and fall have similar ranges and they are distinctly lower than the winter indoor radon range.

The 95% CI is the range within which 95% of the already gathered indoor radon measurements occurred. The confidence level also represents the likelihood that another sample of measurements that had been taken from the same homes on the Sykesville Formation will provide the same results.

C. The skewness estimates showed the data distributions for all four seasons are not symmetric, and the standard errors on the skewness estimates are small (Table 4).

Table 4: Skewness and Interquartile Range for Seasonal Indoor Radon Measurements over the Sykesville Formation

Season	Skewness	Standard Error	IQR
Winter	3.4	± 0.2	3
Spring	3.2	± 0.2	4
Summer	1.6	± 0.2	2
Fall	1.3	±0.2	2

Skewness is a measure of the lack of symmetry. A distribution of the data set is symmetric if it looks the same to the left and right of the center point. In this case, the data sets are not symmetric (see Figures 12 - 15). The standard errors on the skewness are small, indicating that the difference between the measured skewness and expected skewness is small.

The IQR is obtained by subtracting the value for the first quartile (i.e. the value that lies at the boundary between the values in the first and second quarters of the range when the values are arranged in ascending order) from that of the third quartile (i.e. the value that lies at the boundary between the values in the third and fourth quarters of the range, when the values are arranged in ascending order). The IQR gives a measure of the spread represented by only the “inner” half of the entire sample and has the advantage of excluding extreme values. A large IQR is considered one that is larger than the median. In this case, the IQR for all seasons is about the same as their medians. This suggests that seasonal indoor radon measurements are not clustered around the medians.

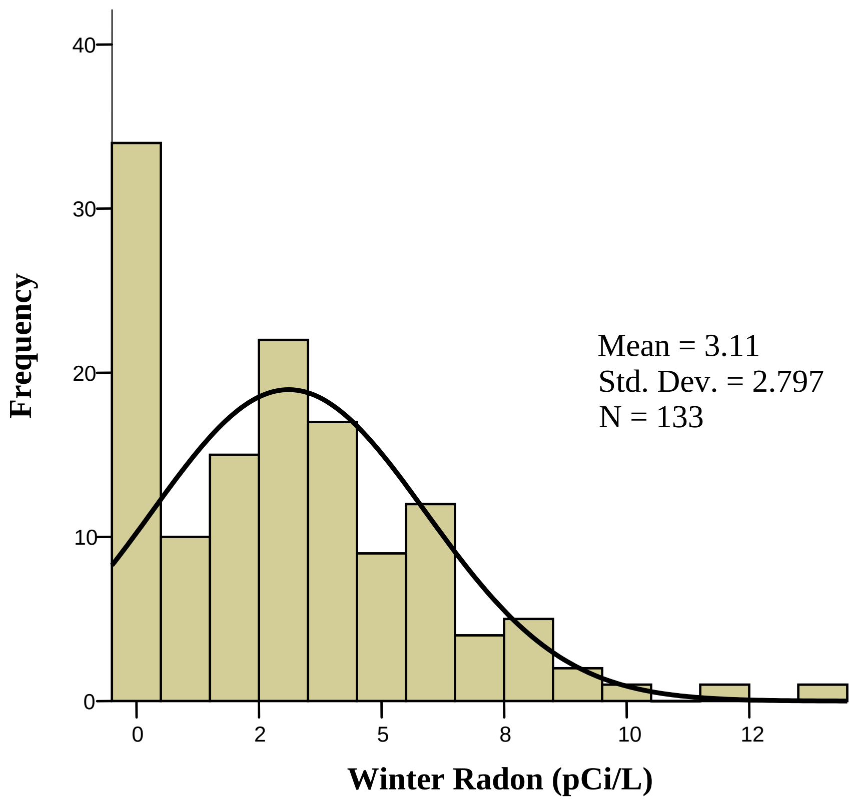


Figure 16: Histogram of Winter Indoor Radon in the Pope's Head Formation Homes

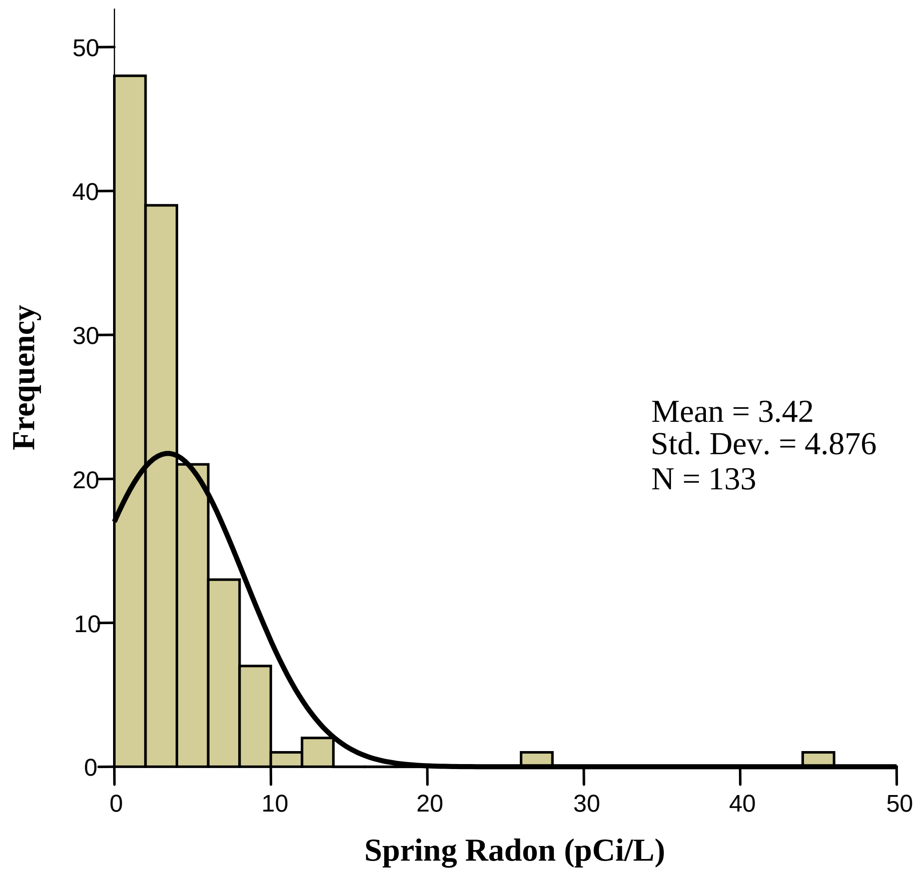


Figure 17: Histogram of Spring Indoor Radon in the Pope's Head Formation Homes

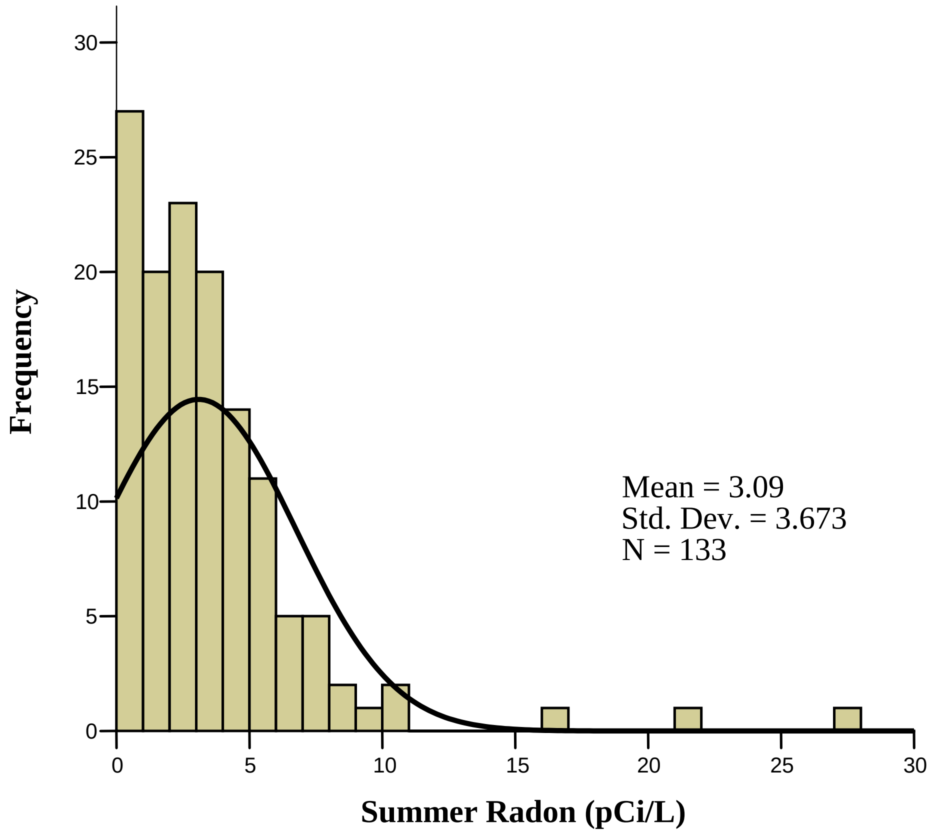


Figure 18: Histogram of Summer Indoor Radon in the Pope's Head Formation Homes

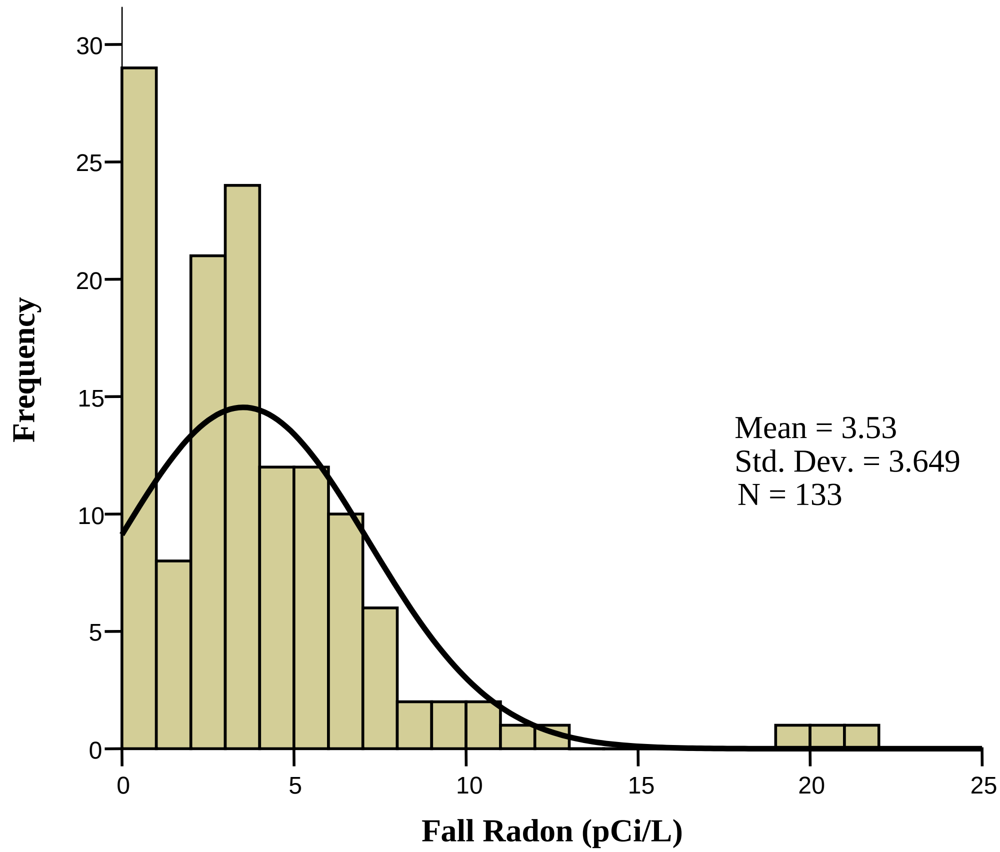


Figure 19: Histogram of Fall Indoor Radon in the Pope's Head Formation Homes

IV.2. Indoor Radon and Homes on the Pope's Head Formation

Appendix 6 presents seasonal indoor radon measurements and aeroradioactivity for the Pope's Head Formation homes. Tables 5 – 7 present an interpretation of the data from the Pope's Head homes:

A. Within the bounds of the standard errors, the mean (average) indoor radon values for the four seasons are close (Table 5).

Table 5: Means and the Standard Error of the Means for Seasonal Indoor Radon Measurements over the Pope's Head Formation

Season	Mean	Standard Error	Sample Size
Winter	3.1	± 0.2	133
Spring	3.4	± 0.4	133
Summer	3.1	± 0.3	133
Fall	3.5	± 0.3	133

The mean seasonal radon ranges from 3.1 to 3.5 pCi/L, and the standard error of each mean is ± 0.2 to ± 0.4. These are small standard errors, so for example, if measurements of winter indoor radon in this group of homes had been repeated many times, we would continue to get a mean of about 3.1 pCi/L. Table 5 shows that indoor radon is almost the same in all four seasons.

B. The 95% confidence interval (lower) and 95% confidence interval (upper) about the means are similar for all four seasons (Table 6).

Table 6: 95% Confidence Interval (CI) for Seasonal Indoor radon Measurements over the Pope's Head Formation

Season	**95% CI (Lower)**	**95% CI (Upper)**	**Size of CI Range**
Winter	2.6	3.6	1.0
Spring	2.6	4.3	1.7
Summer	2.5	3.7	1.2
Fall	2.9	4.2	1.3

This indicates that the range, which contains the true mean on 95% of occasions if our study were repeated many times, using samples of radon measurements from the same homes during the same measurement season, is almost the same for all four seasons.

C. The skewness estimates showed the data distributions for all four seasons are not symmetric, and the standard errors on the skewness estimates are small (Table 7).

Table 7: Skewness for Seasonal Indoor Radon Measurements over the Pope's Head Formation

Season	Skewness	Standard Error	IQR
Winter	1.0	± 0.2	5
Spring	5.3	± 0.2	3
Summer	3.4	± 0.2	3
Fall	2.3	± 0.2	4

The data sets are not symmetric (see Figures 12 - 15). The standard errors on the skewness are small, indicating that the difference between the measured skewness and expected skewness is small. In this case, the IQR for each season is about the same as their medians. This suggests that seasonal indoor radon measurements are not clustered around the medians.

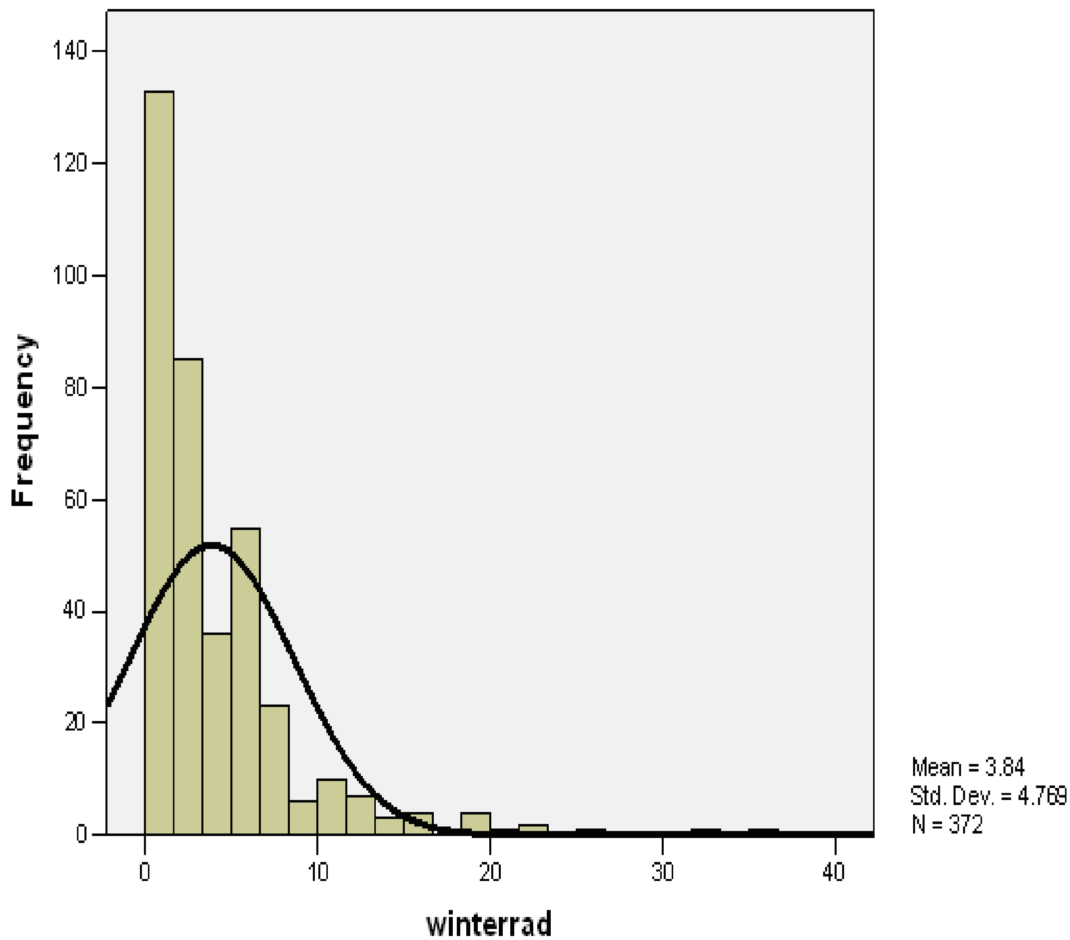


Figure 20: Histogram of Winter Indoor Radon in the Mather Gorge Formation Homes

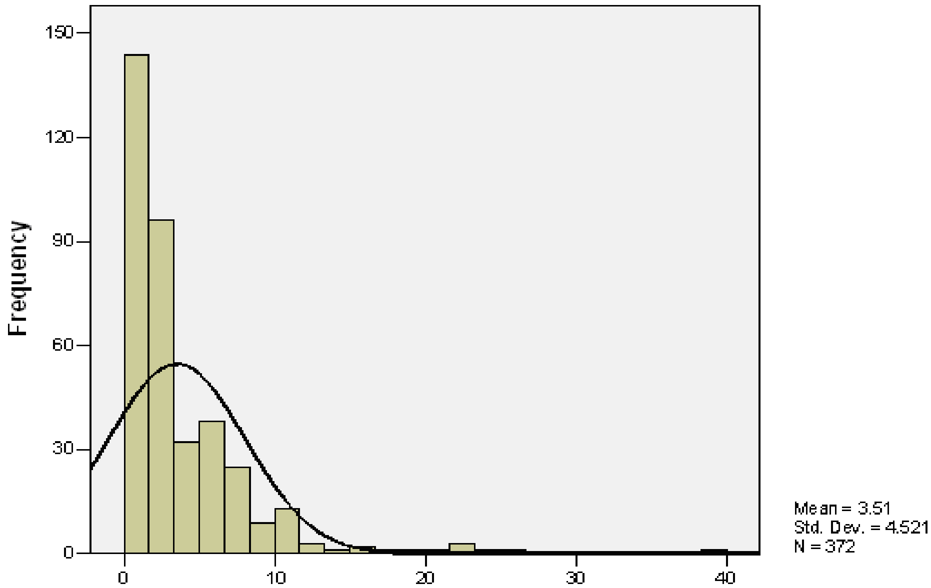


Figure 21: Histogram of Spring Indoor Radon in the Mather Gorge Formation Homes

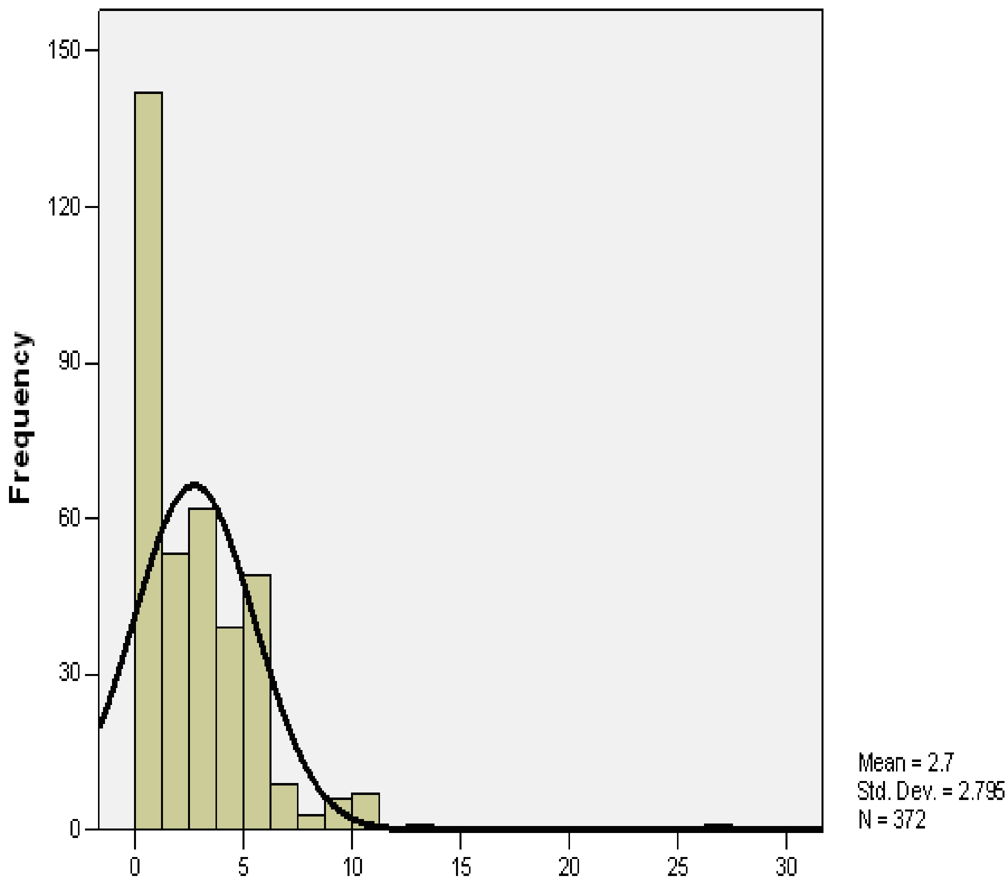


Figure 22: Histogram of Summer Indoor Radon in the Mather Gorge Formation Homes

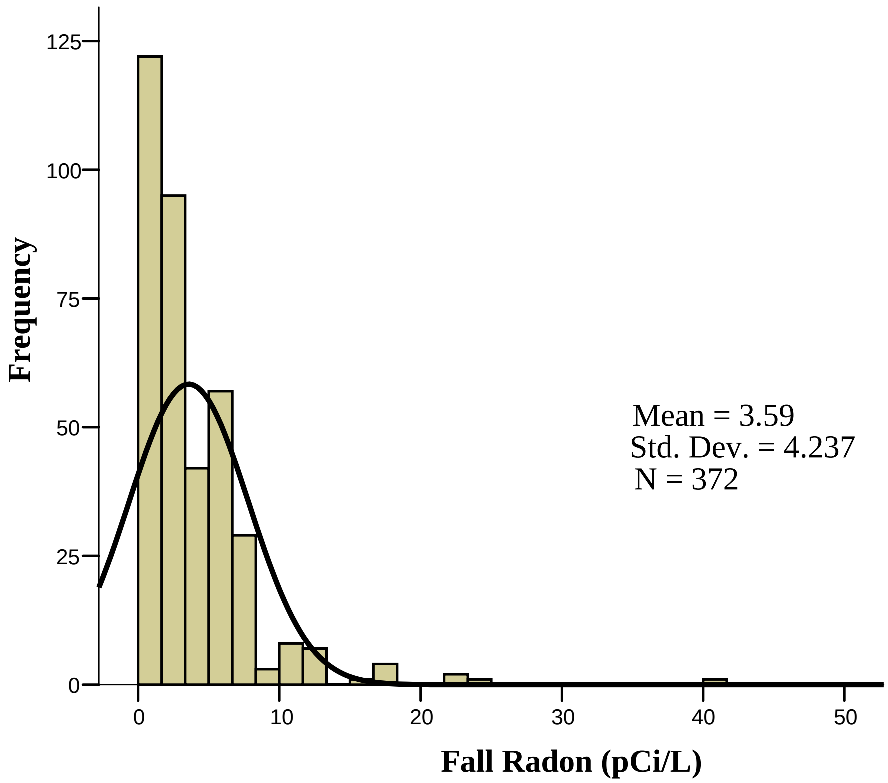


Figure 23: Histogram of Fall Indoor Radon in the Mather Gorge Formation Homes

IV.3. Indoor Radon and Homes on the Mather Gorge Formation

Appendix 7 presents seasonal indoor radon measurements and aeroradioactivity for the Mather Gorge Formation homes. Tables 8 – 10 present an interpretation of the data from the Mather Gorge homes:

C. Within the bounds of the standard errors, the mean (average) indoor radon values for the four seasons are close (Table 8).

Table 8: Means and the Standard Error of the Means for Seasonal Indoor Radon Measurements over the Mather Gorge Formation

Season	Mean	Standard Error	Sample Size
Winter	3.8	± 0.2	372
Spring	3.5	± 0.2	372
Summer	2.7	± 0.1	372
Fall	3.6	± 0.2	372

The mean seasonal radon ranges from 2.7 to 3.8 pCi/L, and the standard error of each mean is ± 0.1 to ± 0.2. These are small standard errors, so, for example, if measurements of winter indoor radon in this group of homes had been repeated many times, we would continue to get a mean of about 3.8 pCi/L. Table 8 shows that indoor radon was distinctly lower in the summer.

B. The 95% confidence interval (lower) and 95% confidence interval (upper) about the means are similar for all four seasons (Table 9).

Table 9: 95% Confidence Interval (CI) for Seasonal Indoor radon Measurements over the Mather Gorge Formation

Season	**95% CI (Lower)**	**95% CI (Upper)**	**Size of CI Range**
Winter	3.4	4.3	0.9
Spring	3.1	4.0	0.9
Summer	2.4	3.0	0.6
Fall	3.2	4.0	0.8

This indicates that the range, which contains the true mean on 95% of occasions if our study were repeated many times, using samples of radon measurements from the same homes during the same measurement season, is almost the same for all four seasons.

C. The skewness estimates showed the data distributions for all four seasons are not symmetric, and the standard errors on the skewness estimates are small (Table 10).

Table 10: Skewness and Interquartile Range for Seasonal Indoor Radon Measurements over the Mather Gorge Formation

Season	Skewness	Standard Error	IQR
Winter	2.7	±0.1	0.1
Spring	3.0	± 0.1	0.1
Summer	2.5	± 0.1	0.1
Fall	3.3	±0.1	0.1

The data sets are not symmetric (see Figures 12 - 15). The standard errors on the skewness are small, indicating that the difference between the measured skewness and expected skewness is small. In this case, the IQR for each season is about the same as their medians. This suggests that seasonal indoor radon measurements are not clustered around the medians.

IV.4. Comparisons Between Seasonal Radon Means

Results for the Levene t test of homogeneity of variance (null hypothesis H_0: $S^2_w = S^2_{sp} = S^2_{su} = S^2_f$ vs alternative hypothesis H_a: $S^2_i \neq S^2_j$ for some $i \neq j$) is shown in Table 11. Clearly, the hypothesis of homogeneity is rejected at better than .01% (.0001) level of significance, as shown in Table 11, in favor of the alternative.

Table 11: Levene T Test of Homogeneity of Variance

Value

Levene Statistic	df1	df2	Sig.
17.181	3	4816	.000

As shown in Table 12, the result of the F test of comparison of means (of radon measures) for the different seasons (null hypothesis H_0: $\mu_w = \mu_{sp} = \mu_{su} = \mu_f$ vs alternative hypothesis H_a: $\mu_i \neq \mu_j$ for some $i \neq j$) clearly rejects the null hypothesis in favor of the alternative. Now we have to find which seasons have statistically different means. Hence, we must form contrasts (linear combination of means whose coefficients add up to zero). Since the variance for summer measure of radon is lower, it must be tested first (Table 13).

Table 12: F Test of Comparison of Means

ANOVA

Value

	Sum of Squares	df	Mean Square	Sig.
Between Groups	469.420	3	11.241	.000
Within Groups	67039.935	4816		
Total	67509.355	4819		

Table 13: Contrast Coefficients

Contrast	**S**			
	1	2	3	4
1	-1	-1	3	-1
2	1	1	-1	-1
3	0	1	0	-1

a) The hypothesis is that the summer mean is equal to the average of the means of the other three seasons: null hypothesis H_0: $\mu_{su} = 1/3(\mu_w + \mu_{sp} + \mu_f)$, which simplifies to $-\mu_w - \mu_{sp} + 3\mu_{su} - \mu_f = 0$, vs alternative hypothesis H_a: $-\mu_w - \mu_{sp} + 3\mu_{su} - \mu_f \neq 0$, which requires a two-tail t test.

b) The second hypothesis to test is the equality of winter and spring vs summer and fall. Contrast: $\mu_w + \mu_{sp} = \mu_{su} + \mu_f$, which simplifies to H_0: $\mu_w + \mu_{sp} - \mu_{su} - \mu_f = 0$ vs H_a: : $\mu_w + \mu_{sp} - \mu_{su} - \mu_f \neq 0$; again, a two-tail t test.

c) The third comparison is between spring and fall: H_0: $\mu_{sp} - \mu_f = 0$ vs H_a: $\mu_{sp} - \mu_f \neq 0$; again, a two-tail t test. This is written with all season means in the contrast as: $0\mu_w + \mu_{sp} + 0\mu_{su} - \mu_f = 0$ vs H_a: $0\mu_w + \mu_{sp} + 0\mu_{su} - \mu_f \neq 0$; again, a two-tail t test.

The three contrasts are shown in the Table 14 with all their coefficients as defined above. Note that the coefficients are in the order of the four seasons: winter, spring, summer, and fall (i.e., winter = 1; spring = 2; summer = 3; fall = 4).

Table 14: Linear Combination of Means

Contrast	S			
	1	2	3	4
1	-1	-1	3	-1
2	1	1	-1	-1
3	0	1	0	-1

The results of tests on those hypotheses are shown in the Table 15. Clearly, summer is significantly different from the rest of the seasons at better than .01% (.0001) level; as a group, winter and spring are significantly different from summer and fall at the .1% (.001) level. Finally, there is not enough evidence to reject the equality of spring and fall based on the data, that is, we fail to reject that last hypothesis. This trend is consistent with the spatial pattern for summer radon (see Figure 5).

Table 15: Contrast Tests

		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Value	Assume equal variances	1	-2.00	.372	-5.374	4816	.000
		2	.71	.215	3.285	4816	.001
		3	-.14	.152	-.901	4816	.368
	Does not assume equal variances	1	-2.00	.303	-6.604	3192.470	.000
		2	.71	.215	3.285	4432.034	.001
		3	-.14	.163	-.841	2406.431	.401

IV.5. Comparisons Between Geological Units

A summary by season of the three geological units for which many measurements of indoor radon are available are shown in Tables 2 - 15. The radon values (mean, median and trimmed mean) when evaluated (standard deviation, 95% C.I., 5% trimmed mean and IQR) are found to be so close as to be essentially identical (all are about 3 pCi/L at the 95% C.L.). It can be concluded that indoor radon risk maps that carry a high confidence level cannot be created based on the delineation of particular geological units. This seems to contrast with studies that suggest that geological knowledge is useful in predicting and mapping residential radon concentrations (Shi et al., 2006), and that sound predictions can be made with some level of uncertainty (Andersen et al., 2007).

It is anticipated, but not proven, that when more measurements become available, it may be found that some geological units for which we now have few data might be found to have very high or very low indoor radon. Unfortunately, at this time, many of these units have only a few available measurements (see Tables 16 - 19). It is important that additional work be done on this possibility, because if units with high radon in homes exist, it could encourage the constructor of a new house on high-risk soils to use radon-gas resistant construction methods.

Table 16: Winter Indoor Radon

Geologic Unit	# of Homes	Mean Radon (pCi/L)	Median Radon (pCi/L)	Standard Deviation (pCi/L)	95% C.L.	5% Trimmed Mean.	IQR
Sykesville Formation	143	3.2	3.0	3.7	2.5 – 3.8	2.7	3
Pope's Head Formation	133	3.1	3.0	2.8	2.6 - 3.6	2.9	5
Mather Gorge Formation	372	3.8	3.0	4.8	3.4 – 4.3	2.3	5

Table 17: Spring Indoor Radon

Geologic Unit	# of Homes	Mean Radon (pCi/L)	Median Radon (pCi/L)	Standard Deviation (pCi/L)	95% C.L.	5% Trimmed Mean.	IQR
Sykesville Formation	143	2.4	2.0	2.4	1.9 – 2.1	2.1	4
Pope's Head Formation	133	3.4	3.0	4.9	2.6 – 4.3	2.8	3
Mather Gorge Formation	372	3.5	2.0	4.5	3.1 – 4.0	2.9	5

Table 18: Summer Indoor Radon

Geologic Unit	# of Homes	Mean Radon (pCi/L)	Median Radon (pCi/L)	Standard Deviation (pCi/L)	95% C.L.	5% Trimmed Mean.	IQR
Sykesville Formation	143	2.5	2.0	2.2	2.5 – 2.9	2.3	2
Pope's Head Formation	133	3.1	2.0	3.7	2.5 – 3.7	2.6	3
Mather Gorge Formation	372	2.7	2.0	2.8	2.4 – 3.0	2.4	4

Table 19: Fall Indoor Radon

Geologic Unit	# of Homes	Mean Radon (pCi/L)	Median Radon (pCi/L)	Standard Deviation (pCi/L)	95% C.L.	5% Trimmed Mean.	IQR
Sykesville Formation	143	3.0	3.0	2.5	2.6 – 3.4	2.8	2
Pope's Head Formation	133	3.5	3.0	3.6	2.9 – 4.2	3.1	4
Mather Gorge Formation	372	3.6	3.0	4.2	3.2 – 4.0	3.1	5

V. COMPARISON OF SEASONAL INDOOR RADON WITH SLOPE THROUGHOUT THE STUDY AREA

Soils on land in northern Virginia with greater slope tend to be more permeable because they have a higher sand content, and therefore have greater gas flow (Mose, 2006; Siaway et al., 2006; Fairfax County GIS, 2006). Consequently, the hypothesis is advanced that homes with more indoor radon are those that are constructed on land with greater slope. In order to investigate this hypothesis, a three-dimensional visualization was prepared of seasonal indoor radon and slope. Since it was found the variation in the distributions of indoor radon is about the same for all four seasons, the winter indoor radon values are used to visualize the relationship.

Figure 24 shows the distribution of winter indoor radon and slope in Fairfax County, using 33 homesites (see Table 20). The top 3D layer consists of winter indoor radon measurements that were color-coded in varying intensity of light-pink to red. The lower 3D layer consists of the slope data in varying intensity of green to dark blue. The third and lowest layer is the Fairfax County geology base map (Fairfax GeoAreas and Fairfax GeoLines). Figure 24 shows higher winter radon homes that are greater than 3 pCi/L (red color) are mostly found on slopes less than 3% (green color). Also, winter radon homes that are less than 3 pCi/L (light-pink color) are found on slopes that are greater than 3% (blue color).

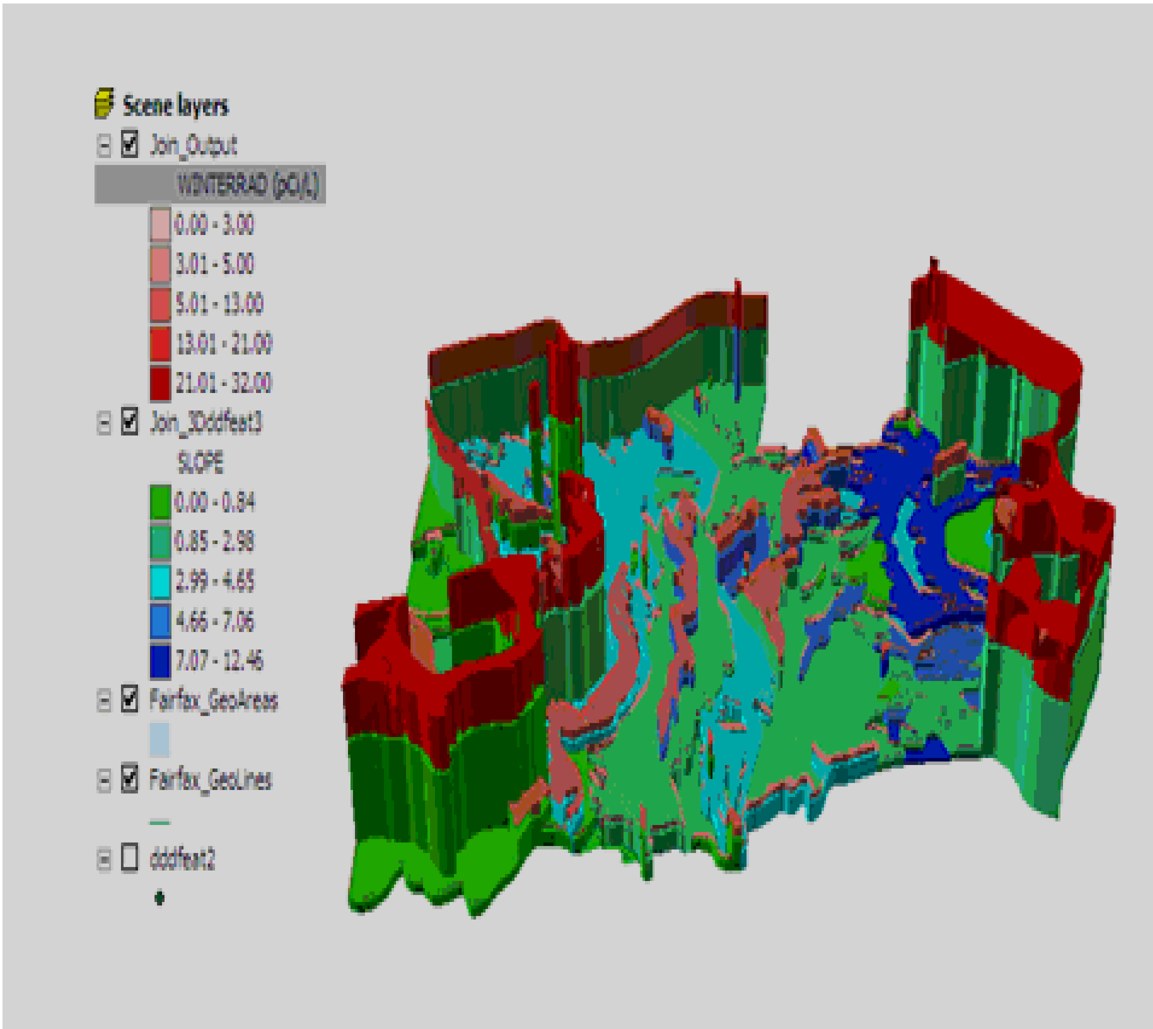


Figure 24: 3D Visualization of Indoor Winter Radon and Slope

Table 20: Comparison of Slope and Radon*

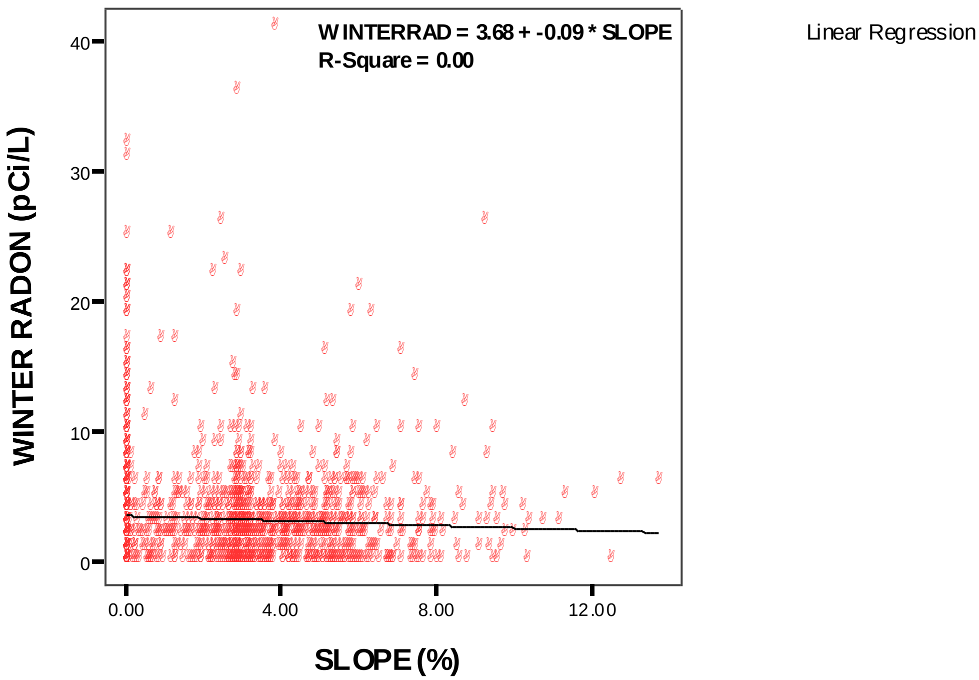
Comparison of Slope and Radon							
Geology	**Slope (%)**	**WINT RAD (pCi/L)**	**SPRG RAD (pCi/L)**	**SUM RAD (pCi/L)**	**FAL RAD (pCi/L)**	**MEAN RAD (pCi/L)**	**Location of Homes**
Sykesville Formation	2.13	0	3	2	3	2.0	Fairfax
Sykesville Formation	0.03	7	7	3	5	5.5	Fairfax
Sykesville Formation	6.44	6	7	5	5	5.8	Fairfax
Sykesville Formation	2.88	4	5	6	6	5.3	McLean
Sykesville Formation	3.71	4	2	2	2	2.5	Fairfax
Sykesville Formation	3.60	3	2	2	1	2.0	Burke
Pope's Head Formation	6.41	1	1	3	1	1.5	McLean
Pope's Head Formation	0.00	1	1	1	1	1.0	Falls Church
Pope's Head Formation	0.00	9	5	3	4	5.3	Manassas
Mather Gorge Formation	0.00	0	0	0	0	0.0	Clifton
Mather Gorge Formation	2.97	22	10	9	6	11.8	Oakton
Mather Gorge Formation	5.71	6	3	4	6	4.8	McLean
Mather Gorge Formation	1.24	0	0	0	0	0.0	Great Falls
Mather Gorge Formation	1.26	5	3	3	3	3.5	Oakton
Mather	0.00	3	3	4	5	3.8	Great Falls

Comparison of Slope and Radon							
Geology	**Slope (%)**	**WINT RAD (pCi/L)**	**SPRG RAD (pCi/L)**	**SUM RAD (pCi/L)**	**FAL RAD (pCi/L)**	**MEAN RAD (pCi/L)**	**Location of Homes**
Gorge Formation							
Mather Gorge Formation	3.68	3	2	4	4	3.3	Great Falls
Mather Gorge Formation	0.08	2	0	1	0	0.8	Great Falls
Mather Gorge Formation	5.15	4	0	5	4	3.3	Great Falls
Mather Gorge Formation	0.31	0	0	0	0	0.0	McLean
Mather Gorge Formation	2.63	0	0	0	0	0.0	McLean
Mather Gorge Formation	2.34	0	0	0	0	0.0	Great Falls
Mather Gorge Formation	2.34	0	0	0	0	0.0	Great Falls
Mather Gorge Formation	0.00	3	3	5	5	4.0	Reston
Mather Gorge Formation	0.00	32	24	1	41	24.5	Vienna
Mather Gorge Formation	0.00	8	12	8	15	10.8	Reston
Mather Gorge Formation	3.09	3	2	1	4	2.5	Great Falls
Mather Gorge Formation	3.68	3	2	4	4	3.3	Great Falls
Mather	12.46	0	0	0	0	0.0	Woodbridge

Comparison of Slope and Radon							
Geology	**Slope (%)**	**WINT RAD (pCi/L)**	**SPRG RAD (pCi/L)**	**SUM RAD (pCi/L)**	**FAL RAD (pCi/L)**	**MEAN RAD (pCi/L)**	**Location of Homes**
Gorge Formation							
Mather Gorge Formation	0.00	9	8	5	10	8.0	Reston
Mather Gorge Formation	0.00	3	3	3	5	3.5	Clifton
Mather Gorge Formation	0.00	4	5	3	3	3.8	Herndon
Mather Gorge Formation	0.00	4	0	5	4	3.3	Clifton
Mather Gorge Formation	0.00	8	0	4	6	4.5	Herndon
AVERAGE	2.20	5	3	3	5		

*****Slope data were only available for some homes in the study area.

This observation in Figure 24 is tested with Figures 25 – 28, which show that there is a tendency for indoor radon to be less in areas with higher slope. In summary, based on these comparisons, the hypothesis that homes with more indoor radon are on a surface with greater slope is rejected. If geology is not considered, lower indoor radon levels tend to occur more often in areas with higher slopes, and high radon levels more often occur at low slopes. As shown in Table 21, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that slope has correlation with winter radon values. The R-squared is 0.003 and means that approximately 0.3% of the variance of indoor winter radon is accounted for, or predicted by slope. This “tendency” is not strong enough correlation to use in making a high confidence radon potential map, but could be used to make a low confidence map.



P < 0.05 (Significant)

Figure 25: Scatter Plot of Slope and Winter Indoor Radon Measurements

Table 21: Regression Output for Indoor Winter Radon and Slope

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.866	1	87.866	5.429	.020[a]
	Residual	26171.050	1617	16.185		
	Total	26258.915	1618			

a. Predictors: (Constant), SLOPE
b. Dependent Variable: WINTERRAD

VI. COMPARISON OF SEASONAL INDOOR RADON WITH ELEVATION THROUGHOUT THE STUDY AREA

One commonly notes that areas of high elevation tend to have more permeable and sandier soils, and that gas and liquids move faster through such soils. Consequently, it is hypothesized that homes with more indoor radon are on land of greater elevation.

Figure 26 shows a three-dimensional illustration of how homes with indoor radon vary with elevation using 33 homesites (see Table 22). The top 3D layer consists of winter indoor radon measurements that were color-coded in varying intensity of light-pink to red, and the bottom 3D layer consists of the elevation data in varying intensity of green to dark blue. The lowest layer consists of the Fairfax County geology base map (Fairfax GeoAreas and Fairfax GeoLines). Figure 26 appears to show that higher winter radon homes that are greater than 3 pCi/L (red color) are mostly found on elevations less than 181 feet (green color). Also, winter radon homes that are less than 3 pCi/L (light-pink color) are found on elevations that are greater than 181 feet (blue color The F-test is statistically significant, which means that the model is statistically significant, meaning that we are 95% confident that elevation has correlation with winter radon values. The R-squared is 0.007 and means that approximately 0.7% of the variance of indoor winter radon is accounted for, or predicted by elevation (Tables 23-26). This observation is tested with Figures 27 – 30, which show that there is a tendency for indoor radon to be less in areas with higher elevation.

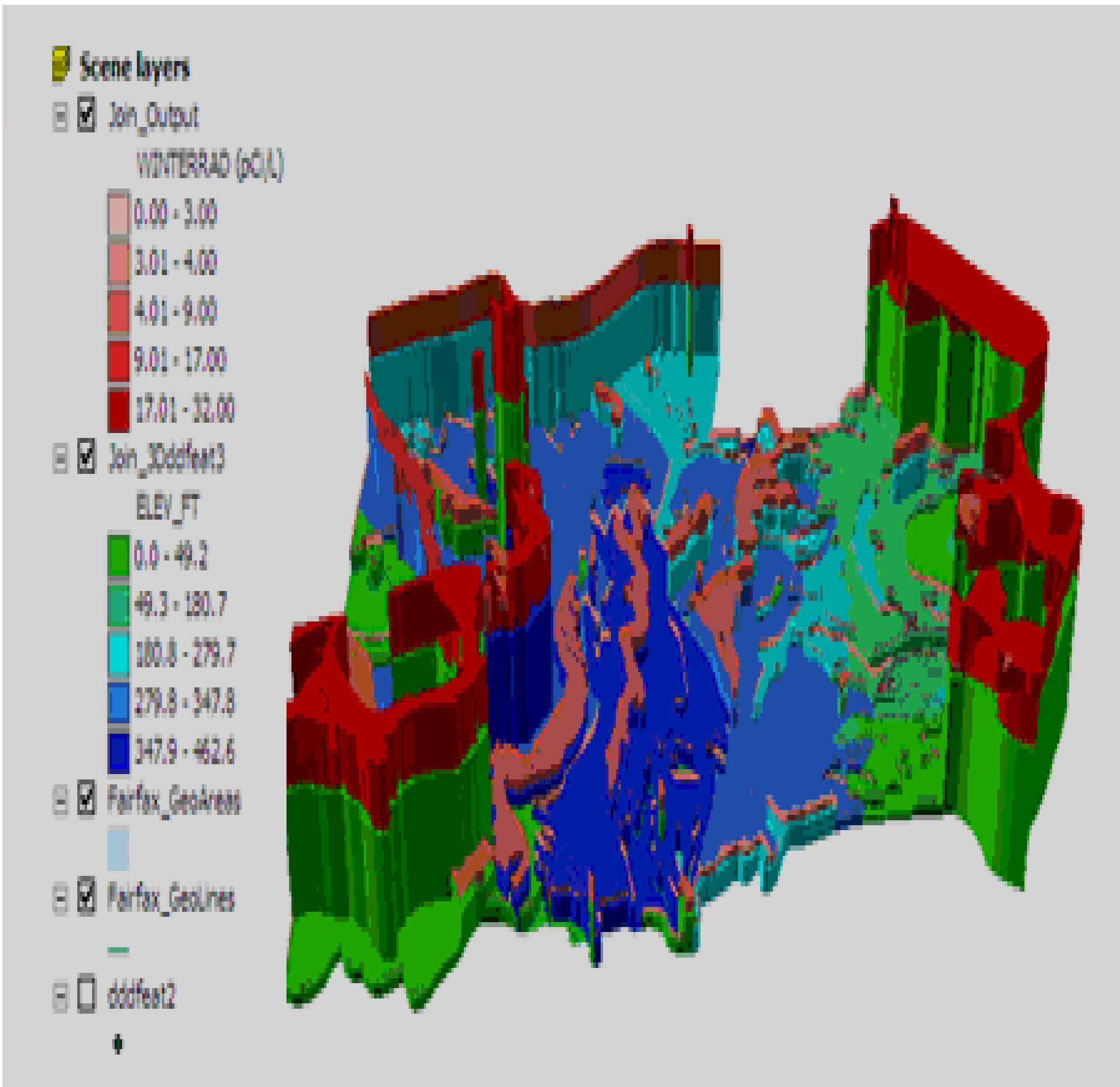


Figure 26: Visualization of Indoor Winter Radon and Elevation

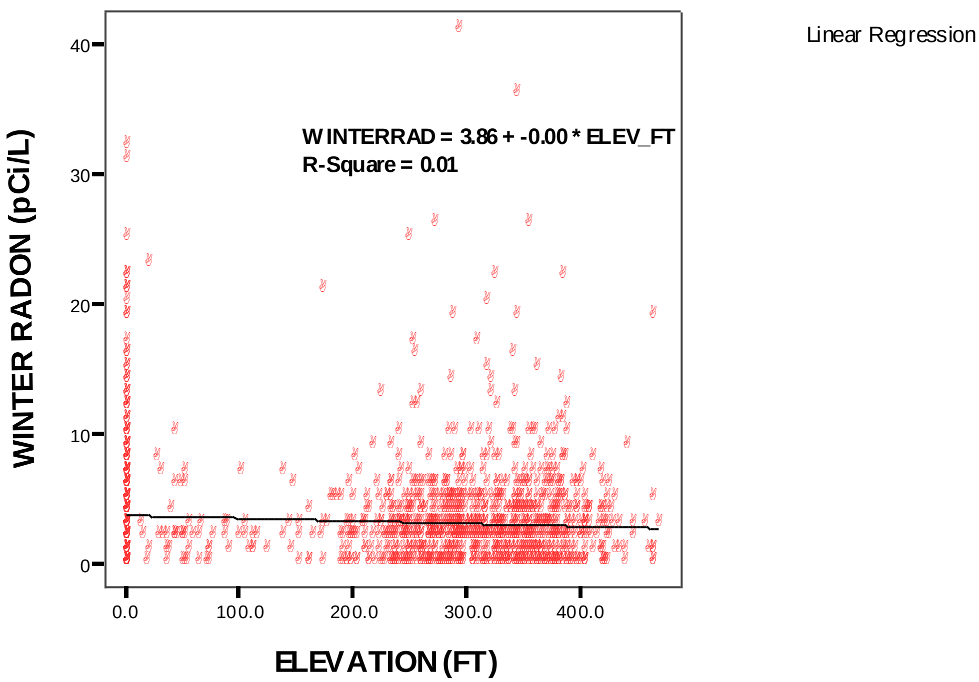
Table 22: Comparison of Elevation and Radon*

Comparison of Elevation and Radon							
GEOLOGY	ELEV (Ft)	WINT RAD (pCi/L)	SPRG RAD (pCi/L)	SUM RAD (pCi/L)	FAL RAD (pCi/L)	MEAN RAD (pCi/L)	LOCATION OF HOMES
Sykesville Formation	377.2	0	3	2	3	2.0	Fairfax
Sykesville Formation	357.6	7	7	3	5	5.5	Fairfax
Sykesville Formation	360.6	6	7	5	5	5.8	Fairfax
Sykesville Formation	260.0	4	5	6	6	5.3	McLean
Sykesville Formation	377.3	4	2	2	2	2.5	Fairfax
Sykesville Formation	423.2	3	2	2	1	2.0	Burke
Pope's Head Formation	285.8	1	1	3	1	1.5	McLean
Pope's Head Formation	341.2	1	1	1	1	1.0	Falls Church
Pope's Head Formation	0.0	9	5	3	4	5.3	Manassas
Mather Gorge Formation	0.0	0	0	0	0	0.0	Clifton
Mather Gorge Formation	383.9	22	10	9	6	11.8	Oakton
Mather Gorge Formation	261.9	6	3	4	6	4.8	McLean
Mather Gorge Formation	315.0	0	0	0	0	0.0	Great Falls
Mather Gorge Formation	360.9	5	3	3	3	3.5	Oakton
Mather Gorge Formation	259.2	3	3	4	5	3.8	Great Falls
Mather Gorge Formation	267.0	3	2	4	4	3.3	Great Falls
Mather Gorge Formation	380.6	2	0	1	0	0.8	Great Falls

Comparison of Elevation and Radon							
GEOLOGY	**ELEV (Ft)**	**WINT RAD (pCi/L)**	**SPRG RAD (pCi/L)**	**SUM RAD (pCi/L)**	**FAL RAD (pCi/L)**	**MEAN RAD (pCi/L)**	**LOCATION OF HOMES**
Mather Gorge Formation	351.3	4	0	5	4	3.3	Great Falls
Mather Gorge Formation	246.1	0	0	0	0	0.0	McLean
Mather Gorge Formation	274.2	0	0	0	0	0.0	McLean
Mather Gorge Formation	305.1	0	0	0	0	0.0	Great Falls
Mather Gorge Formation	305.1	0	0	0	0	0.0	Great Falls
Mather Gorge Formation	0.0	3	3	5	5	4.0	Reston
Mather Gorge Formation	0.0	32	24	1	41	24.5	Vienna
Mather Gorge Formation	0.0	8	12	8	15	10.8	Reston
Mather Gorge Formation	331.4	3	2	1	4	2.5	Great Falls
Mather Gorge Formation	267.0	3	2	4	4	3.3	Great Falls
Mather Gorge Formation	197.3	0	0	0	0	0.0	Woodbridge
Mather Gorge Formation	0.0	9	8	5	10	8.0	Reston
Mather Gorge Formation	0.0	3	3	3	5	3.5	Clifton
Mather Gorge Formation	0.0	4	5	3	3	3.8	Herndon
Mather Gorge Formation	0.0	4	0	5	4	3.3	Clifton
Mather Gorge Formation	0.0	8	0	4	6	4.5	Herndon
AVERAGE	220.9	5	3	3	5		

*****Elevation data were only available for some homes in the study area.

As shown in Figure 27 and Table 23, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that elevation has correlation with winter radon values. The R-squared is 0.002 and means that approximately 0.2% of the variance of indoor winter radon is accounted for, or predicted by elevation.



P < 0.05 (Significant)

Figure 27: Scatter Plot of Elevation and Winter Indoor Radon Measurements

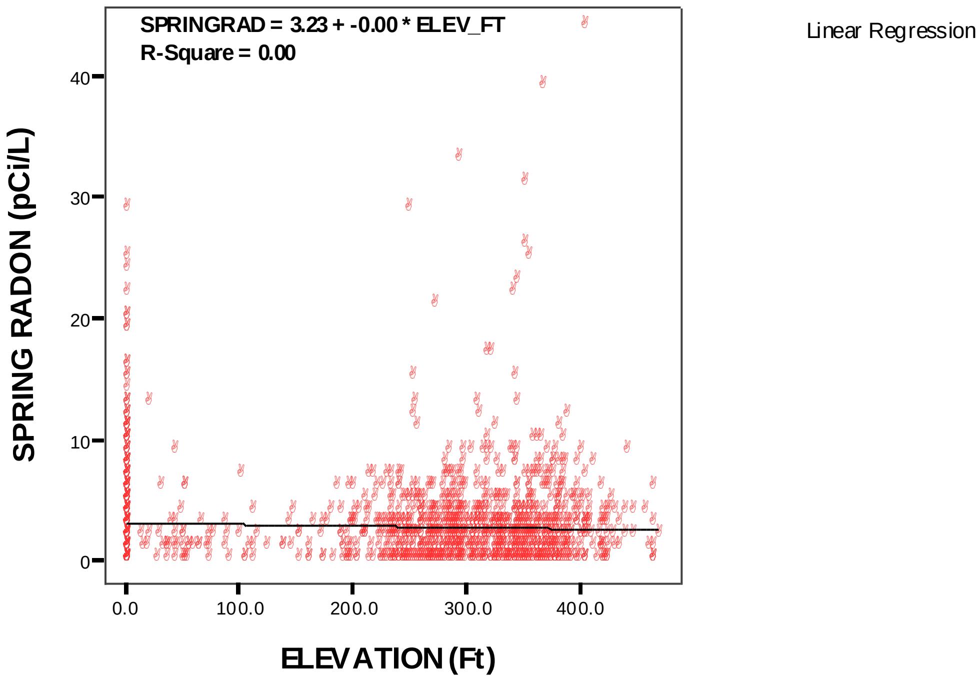
Table 23: Regression Output for Indoor Winter Radon and Elevation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	184.599	1	184.599	11.448	.001[a]
	Residual	26074.317	1617	16.125		
	Total	26258.915	1618			

a. Predictors: (Constant), ELEV_FT
b. Dependent Variable: WINTERRAD

As shown in Figure 28 and Table 24, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that elevation has correlation with spring radon values. The R-squared is 0.002 and means that approximately 0.2% of the variance of indoor spring radon is accounted for, or predicted by elevation.



P < 0.05 (Significant)

Figure 28: Scatter Plot of Elevation and Spring Indoor Radon Measurements

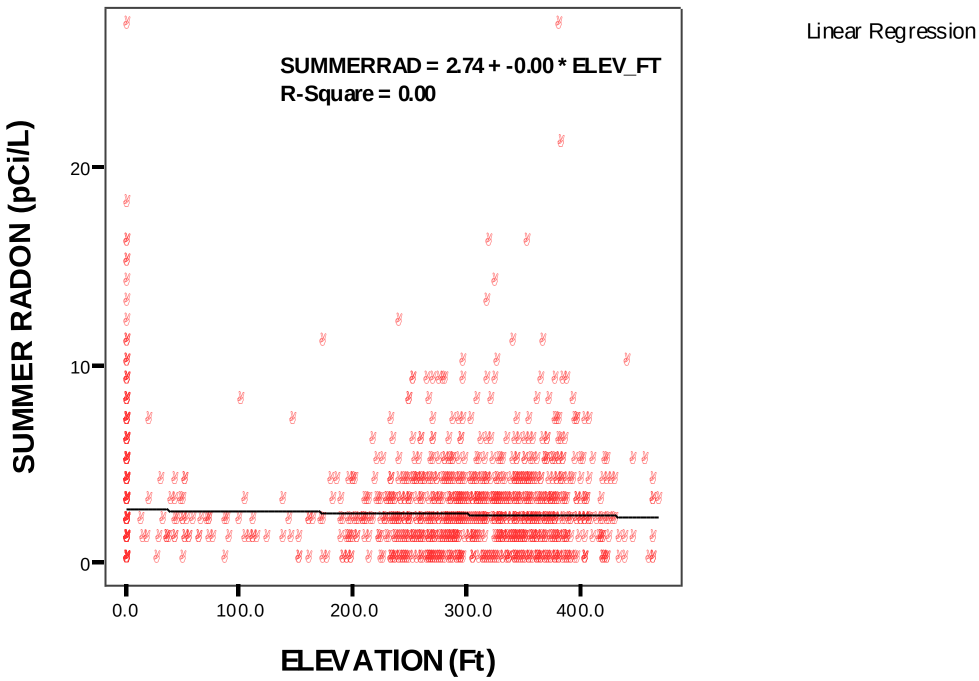
Table 24: Regression Output for Indoor Spring Radon and Elevation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61.605	1	61.605	4.309	.038[a]
	Residual	23115.394	1617	14.295		
	Total	23176.999	1618			

a. Predictors: (Constant), ELEV_FT
b. Dependent Variable: SPRINGRAD

Figure 29 and Table 25 show that the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that elevation has very little correlation with summer radon values. The R-squared is 0.002 and means that approximately 0.2% of the variance of indoor summer radon is accounted for, or predicted by elevation.



P > 0.05 (Not Significant)

Figure 29: Scatter Plot of Elevation and Summer Indoor Radon Measurements

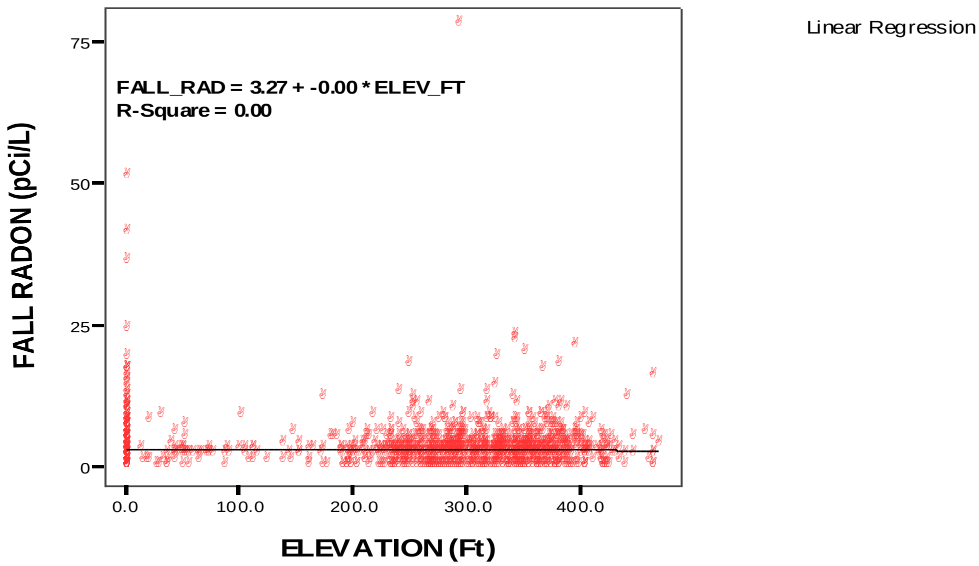
Table 25: Regression Output for Indoor Summer Radon and Elevation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.698	1	24.698	3.679	.055[a]
	Residual	10856.141	1617	6.714		
	Total	10880.839	1618			

a. Predictors: (Constant), ELEV_FT
b. Dependent Variable: SUMMERRAD

As shown in Figure 30 and Table 26, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that elevation has very little correlation with fall radon values. The R-squared is zero and means that approximately zero percent of the variance of indoor fall radon is accounted for, or predicted by elevation.



P > 0.05 (Not Significant)

Figure 30: Scatter Plot of Elevation and Fall Indoor Radon Measurements

Table 26: Regression Output for Indoor Summer Radon and Elevation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.861	1	2.861	.182	.670[a]
	Residual	25475.977	1617	15.755		
	Total	25478.838	1618			

a. Predictors: (Constant), ELEV_FT
b. Dependent Variable: FALL_RAD

In summary, it appears that indoor radon tends to be less in homes of higher elevation. This is a weak inverse correlation, and like the discussion about slope, it is a tendency and is not strong enough correlation to use in creating a high confidence radon potential map. This is supported by the regression outputs that show the association between elevation and indoor winter radon and indoor spring radon is statistically significant, but that of indoor summer and indoor fall radon is not statistically significant. The lower radon-higher elevation can only be used to create a low confidence radon potential map.

VII. COMPARISON OF SEASONAL INDOOR RADON WITH AERORADIOACTIVITY THROUGHOUT THE STUDY AREA

It has been theorized that aeroradioactivity (i.e., airplane measured soil aeroradioactivity) maps might be a useful way to create indoor radon potential maps. In theory, soils showing high or low radioactivity will probably show correlated variations in indoor radon (Mose, 2005), and the aeroradioactivity at homesites was determined for this comparison. Aerial gamma-ray data can be used to quantify and describe the radioactivity of rocks and soils.

Appendix 8a shows the available aeroradioactivity in Fairfax County. Appendix 8b shows the location of each home and the aeroradioactivity at the home location. Appendix 8c presents the location and aeroradioactivity data for each home. X values measure Longitude, which is the distance in degrees east or west of the Prime Meridian. Y values measure Latitude, which is the distance in degrees north or south of the Equator. For example, Appendix 8c shows that home number 1 is located at Longitude -77.2265 and Latitude 38.6724 decimal degrees.

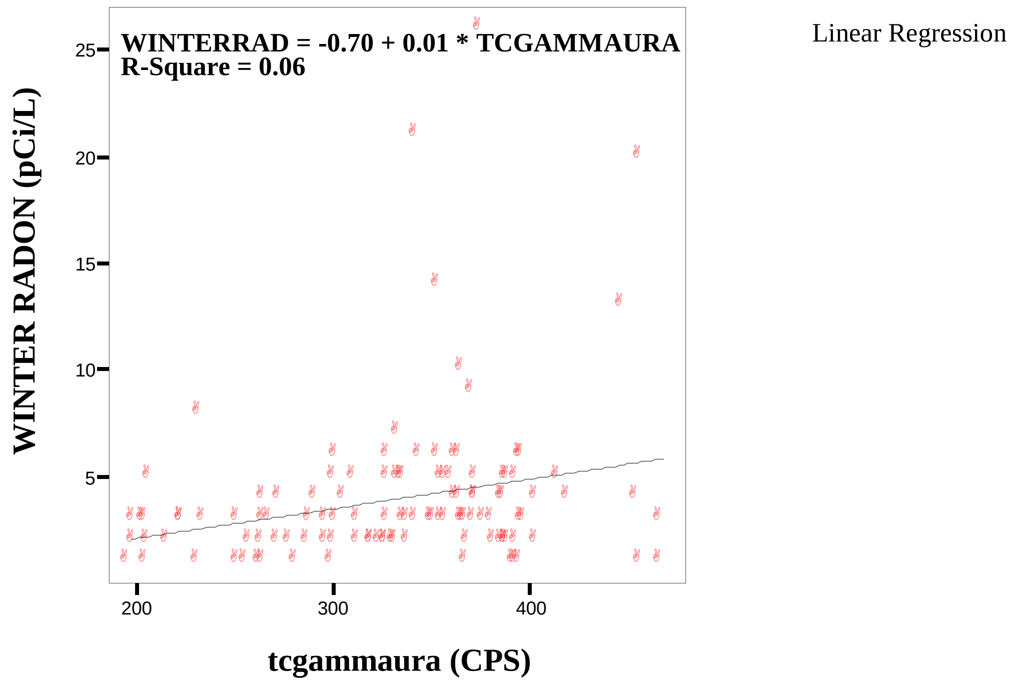
During the 1970s, airborne gamma-ray spectral data were collected throughout the United States along a grid of east-west and north-south flight lines as part of the National

Uranium Resource Evaluation project (NURE) (Duval et al., 1989). East-west lines are typically 3-6 miles apart and north-south lines are typically 12 miles apart. The NURE project used helicopters with special analytical equipment to detect and record the intensity of gamma-ray energy from the decay of bismuth-214 from the uppermost 20 to 30 cm of the surface of soil and rocks at a number of locations along each flight line. The helicopters flew several hundred feet above the surface and measurements were collected, on average, a little more than 100 feet apart along the flight lines. Estimates of the soil and rock uranium content at each location, in parts per million, were calculated using the gamma-ray data that were collected. This technique assumes that uranium and its decay products are in secular equilibrium. These estimates are designated by the abbreviation eU (equivalent uranium) to distinguish them from a conventional chemical analysis of uranium. The estimates are possible because bismuth-214 is one of the radioactive decay products for uranium-238, and the amount of bismuth-214 present will be proportional to the amount of uranium-238 present in the rock or soil. Detailed compilation of aeroradioactivity data is addressed in USGS Open File Report/OFR 02-0361 (USGS, 2001).

The computer then computes the geocentric coordinates for each plot area that are converted by using these points as reference. As the aircraft flies over the initial checkpoint, the Doppler navigation system begins to record the aircraft position in terms of along-track and across-track distances relative to the leg (the line between the beginning and the end checkpoint that is identified by a leg number) initial checkpoint and the predetermined heading. The ground data entered into the computer consists of longitude and latitude of initial checkpoint, longitude and latitude of the end or the closure point, and the recorded across-track values associated with each point. The ground data (radiation-channel observation) entered into the computer is then associated with its longitude and latitude and causes them to be plotted together. That is, the longitudes and latitudes are then converted to rectangular plotter coordinates (x, y). Because radon-222 is followed closely in the decay path by bismuth-214, NURE data are also useful in identifying areas more likely to have elevated radon levels in soil and rock.

Figures 31 - 34 present seasonal indoor radon and aeroradioactivity for Sykesville Formation homes in the four seasons. Figures 35 - 38 present seasonal indoor radon and aeroradioactivity for Pope’s Head Formation homes. Figures 39 - 42 present seasonal indoor radon and aeroradioactivity for Mather Gorge Formation homes. All show that in homes located where the aeroradioactivity is between about 200-350 cps, indoor radon was usually less than 5 pCi/L in all the measured homes. However, for measurements between about 350-600 cps, some radon measurements exceeded 5 pCi/L.

As shown in Figure 31 and Table 27, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that aeroradioactivity has correlation with winter radon values for the Sykesville Formation homes. The R-squared is 0.082 and means that approximately 8.2% of the variance of indoor winter radon is accounted for, or predicted by aeroradioactivity.



P < 0.05 (Significant)

Figure 31: Scatter Plot of Indoor Winter Radon and Aeroradioactivity for Sykesville Formation Homes

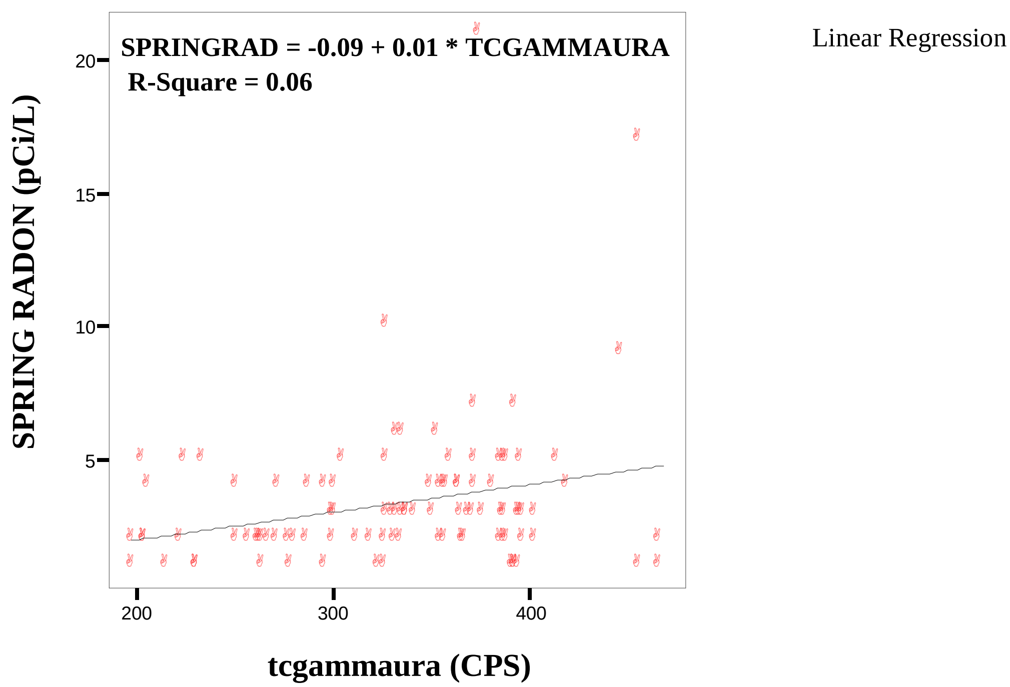
Table 27: Regression Output for Indoor Winter Radon and Tcgammaura Aeroradioactivity for Sykesville Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	159.590	1	159.590	12.587	.001[a]
	Residual	1787.795	141	12.679		
	Total	1947.385	142			

a. Predictors: (Constant), AERO
b. Dependent Variable: WINTERRAD

As shown in Figure 32 and Table 28, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that aeroradioactivity has correlation with spring radon values. The R-squared is 0.077 and means that approximately 7.7% of the variance of indoor spring radon is accounted for, or predicted by aeroradioactivity for the Sykesville Formation homes.



P < 0.05 (Significant)

Figure 32: Scatter Plot of Indoor Spring Radon and Aeroradioactivity for Sykesville Formation Homes

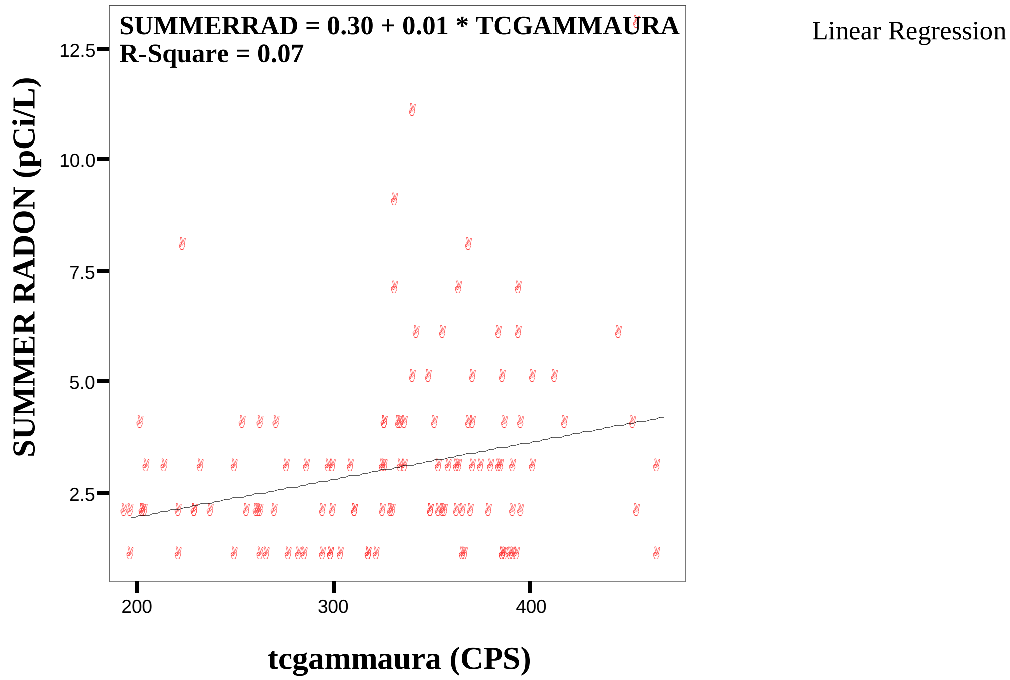
Table 28: Regression Output for Indoor Spring Radon and Tcgammaura for Sykesville Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.956	1	87.956	11.738	.001[a]
	Residual	1056.519	141	7.493		
	Total	1144.476	142			

a. Predictors: (Constant), AERO
b. Dependent Variable: SPRINGRAD

As shown in Figure 33 and Table 29, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that aeroradioactivity has correlation with summer radon values for the Sykesville Formation homes. The R-squared is 0.075 and means that approximately 7.5% of the variance of indoor summer radon is accounted for, or predicted by aeroradioactivity.



P < 0.05 (Significant)

Figure 33: Scatter Plot of Indoor Summer Radon and Aeroradioactivity for Sykesville Formation Homes

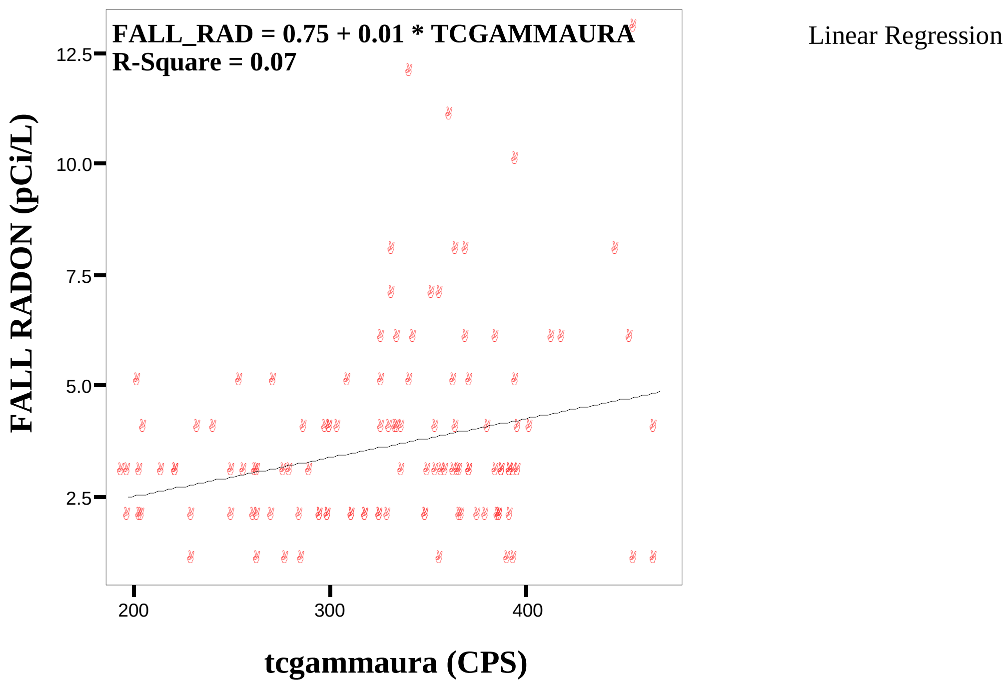
Table 29: Regression Output for Indoor Summer Radon and Tcgammaura for Sykesville Formation Homes

ANOVA[b]

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	53.647	1	53.647	11.494	.001[a]
	Residual	658.087	141	4.667		
	Total	711.734	142			

a. Predictors: (Constant), AERO
b. Dependent Variable: SUMMERRAD

As shown in Figure 34 and Table 30, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that aeroradioactivity has correlation with fall radon values for the Sykesville Formation homes. The R-squared is 0.080 and means that approximately 8% of the variance of indoor fall radon is accounted for, or predicted by aeroradioactivity.



P< 0.05 (Significant)

Figure 34: Scatter Plot of Indoor Fall Radon and Aeroradioactivity for Sykesville Formation Homes

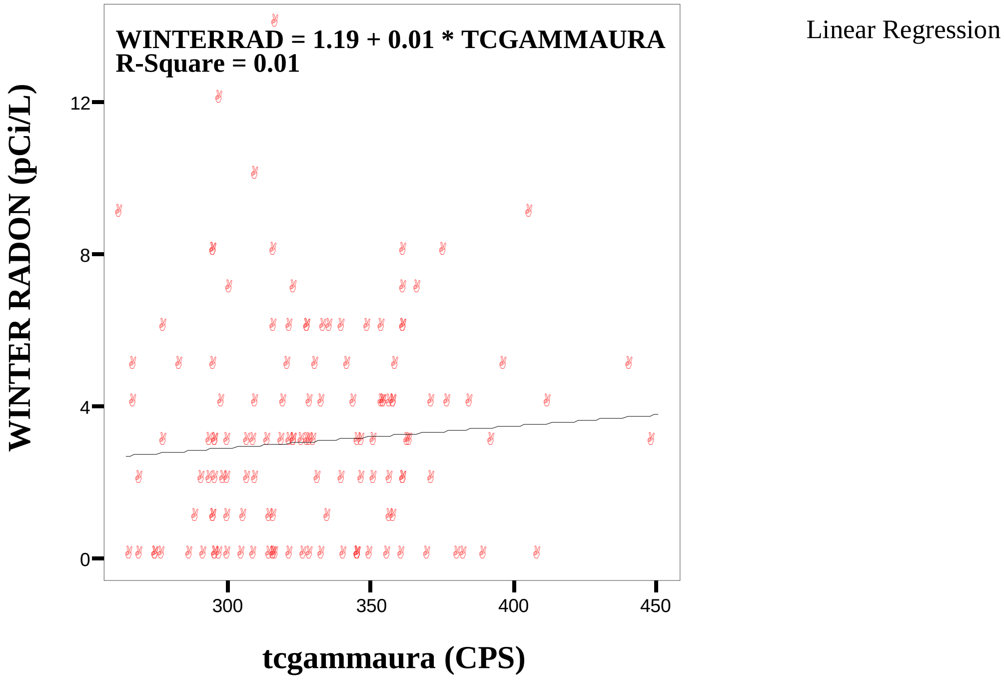
Table 30: Regression Output for Indoor Fall Radon and Tcgammaura for Sykesville Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69.565	1	69.565	12.254	.001[a]
	Residual	800.435	141	5.677		
	Total	870.000	142			

a. Predictors: (Constant), AERO
b. Dependent Variable: FALLRAD

As shown in Figure 35 and Table 31, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that aeroradioactivity has very little correlation with winter radon values for the Pope's Head Formation homes. The R-squared is 0.001 and means that approximately 0.1% of the variance of indoor winter radon is accounted for, or predicted by aeroradioactivity.



P > 0.05 (Not Significant)

Figure 35: Scatter Plot of Indoor Winter Radon and Aeroradioactivity for Pope's Head Formation Homes

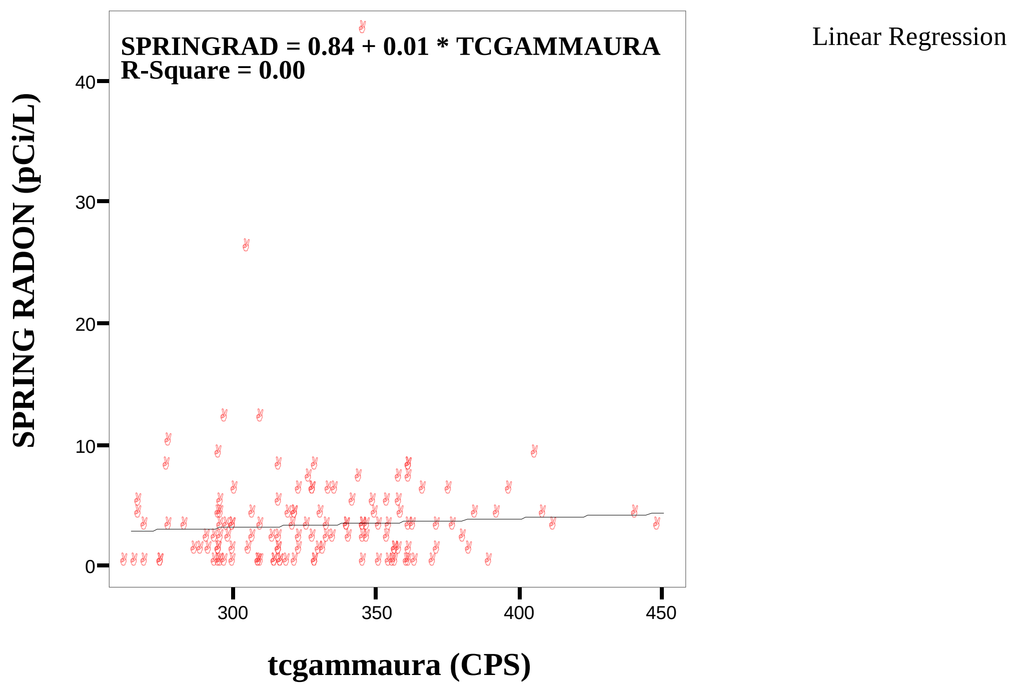
Table 31: Regression Output for Indoor Winter Radon and Tcgammaura for Pope's Head Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.749	1	.749	.124	.725[a]
	Residual	597.311	99	6.033		
	Total	598.059	100			

a. Predictors: (Constant), AERO
b. Dependent Variable: WINTERRAD

As shown in Figure 36 and Table 32, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that aeroradioactivity has very little correlation with spring radon values for the Pope's Head Formation homes. The R-squared is zero and means that approximately zero percent of the variance of indoor spring radon is accounted for, or predicted by aeroradioactivity.



P > 0.05 (Not Significant)

Figure 36: Scatter Plot of Indoor Spring Radon and Aeroradioactivity for Pope's Head Formation Homes

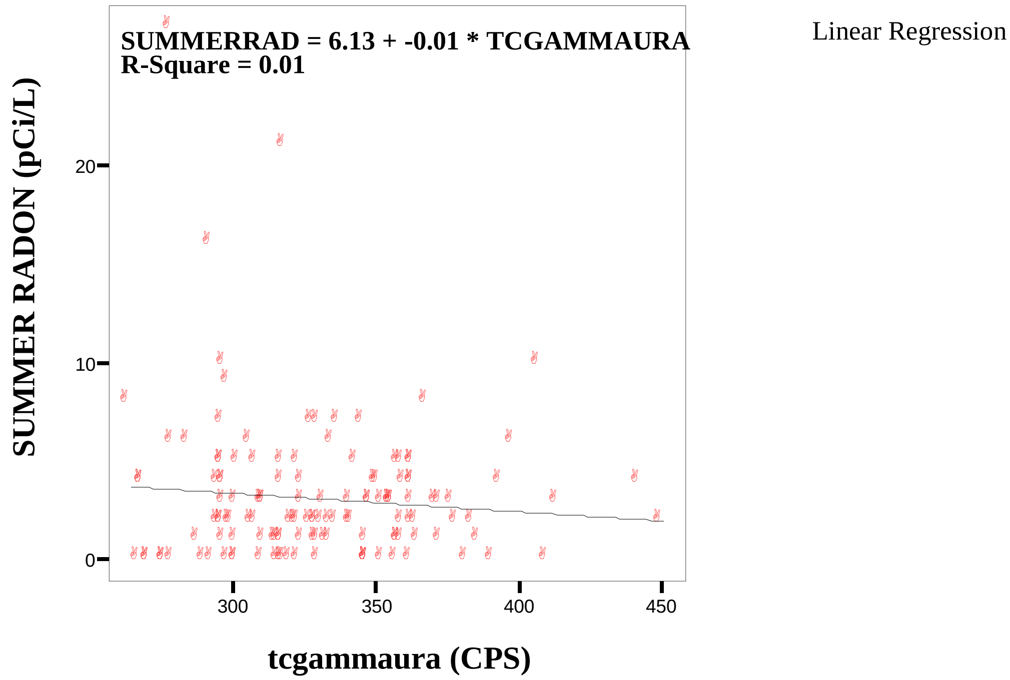
Table 32: Regression Output for Indoor Spring Radon and Tcgammaura for Pope's Head Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.032	1	.032	.001	.972[a]
	Residual	2690.804	102	26.380		
	Total	2690.837	103			

a. Predictors: (Constant), AERO
b. Dependent Variable: SPRINGRAD

As shown in Figure 37 and Table 33, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that aeroradioactivity has very little correlation with summer radon values for the Pope's Head Formation homes. The R-squared is 0.036 and means that approximately 3.6% percent of the variance of indoor summer radon is accounted for, or predicted by aeroradioactivity.



P > 0 05 (Not Significant)

Figure 37: Scatter Plot of Indoor Summer Radon and Aeroradioactivity for Pope's Head Formation Homes

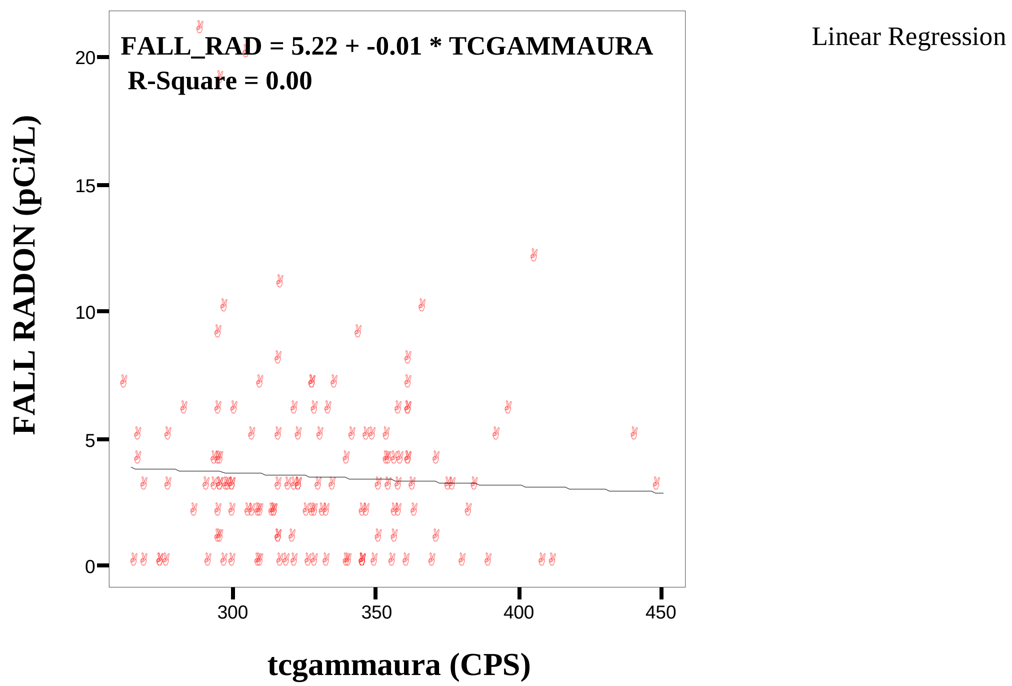
Table 33: Regression Output of Indoor Summer Radon and Tcgammaura for Pope's Head Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	53.308	1	53.308	3.977	.049[a]
	Residual	1407.589	105	13.406		
	Total	1460.897	106			

a. Predictors: (Constant), AERO
b. Dependent Variable: SUMMERRAD

As shown in Figure 38 and Table 34, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that aeroradioactivity has very little correlation with fall radon values. The R-squared is 0.004 and means that approximately 0.4% percent of the variance of indoor fall radon is accounted for, or predicted by aeroradioactivity for the Pope's Head Formation homes.



P > 0.05 (Not Significant)

Figure 38: Scatter Plot of Indoor Fall Radon and Aeroradioactivity for Pope's Head Formation Homes

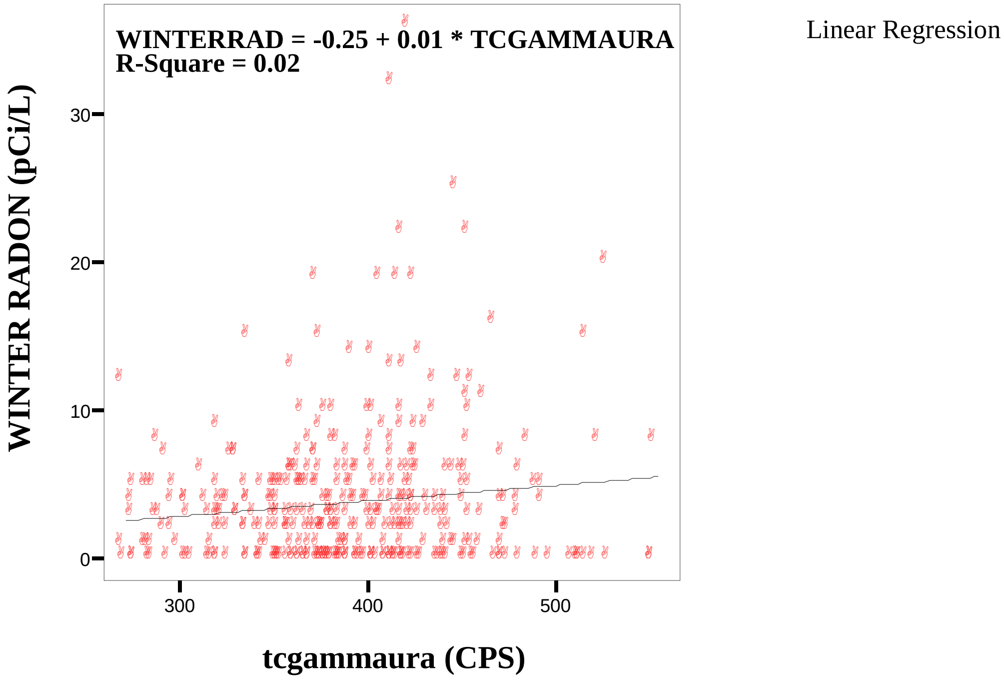
Table 34: Regression Output for Indoor Fall Radon and Tcgammaura for Pope's Head Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.367	1	5.367	.428	.515[a]
	Residual	1292.881	103	12.552		
	Total	1298.248	104			

a. Predictors: (Constant), AERO
b. Dependent Variable: FALLRAD

As shown in Figure 39 and Table 35, the F-test is statistically significant, which means that the model is statistically significant. That is, we are 95% confident that aeroradioactivity has correlation with winter radon values. The R-squared is 0.015 and means that approximately 1.5% percent of the variance of indoor winter radon is accounted for, or predicted by aeroradioactivity for the Mather Gorge Formation homes.



P < 0.05 (Significant)

Figure 39: Scatter Plot of Indoor Winter Radon and Aeroradioactivity for Mather Gorge Formation Homes

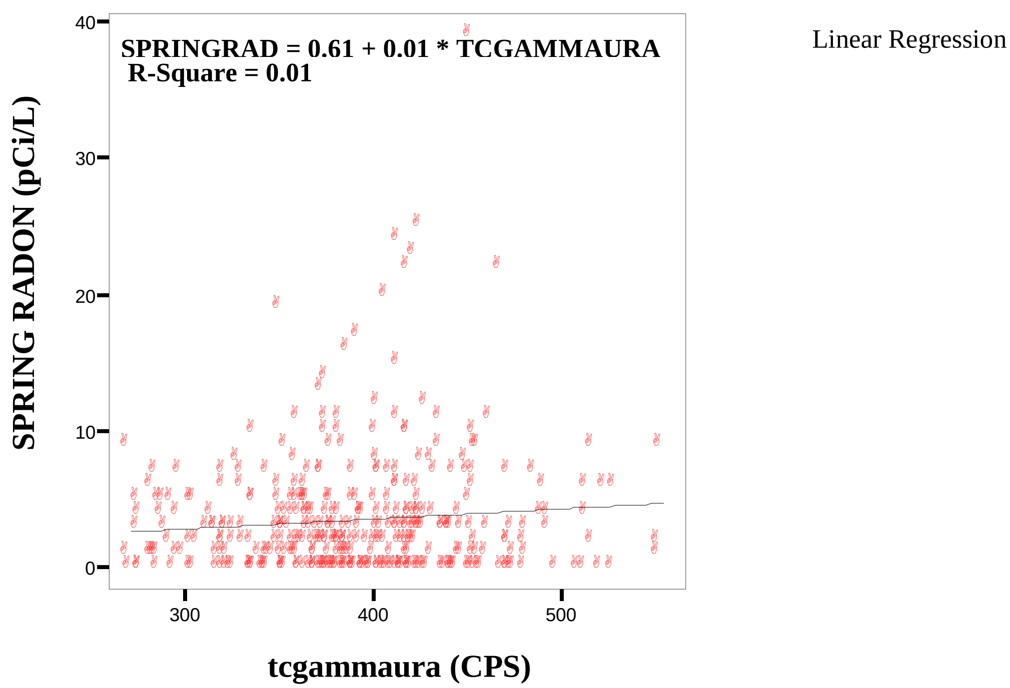
Table 35: Regression Output for Indoor Winter Radon and Tcgammaura for Mather Gorge Formation Homes

ANOVA[b]

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	127.493	1	127.493	5.677	.018[a]
	Residual	8309.464	370	22.458		
	Total	8436.957	371			

a. Predictors: (Constant), AERO
b. Dependent Variable: WINTERRAD

As shown in Figure 40 and Table 36, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that aeroradioactivity has very little correlation with spring radon values. The R-squared is 0.008 and means that approximately 0.8% percent of the variance of indoor spring radon is accounted for, or predicted by aeroradioactivity for the Mather Gorge Formation homes.



P > 0.05 (Not Significant)

Figure 40: Scatter Plot of Indoor Spring Radon and Aeroradioactivity for Mather Gorge Formation Homes

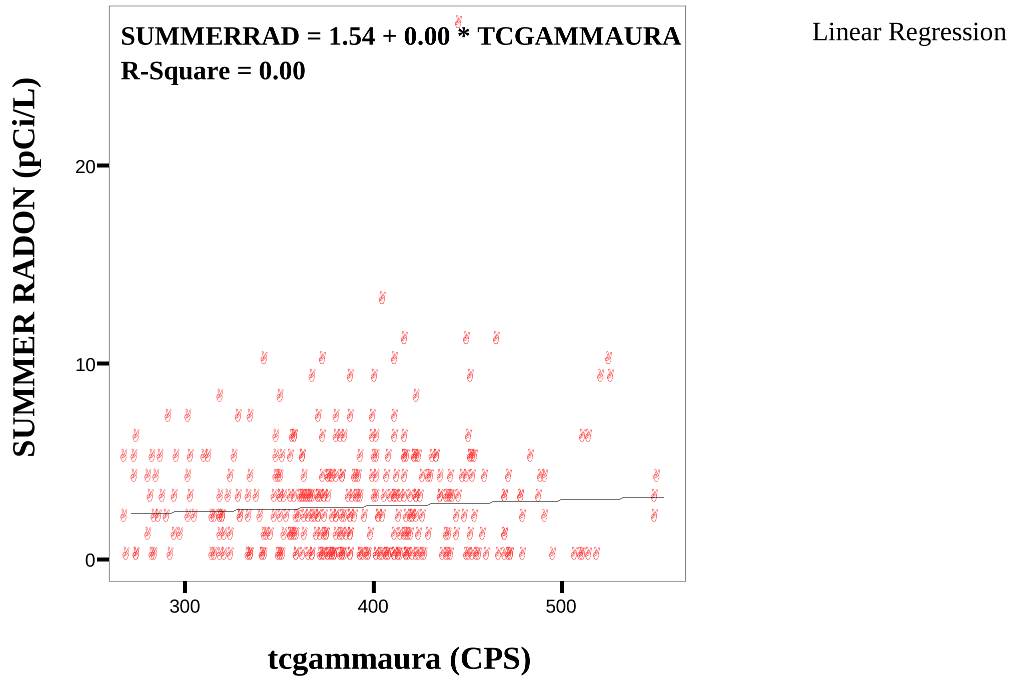
Table 36: Regression Output for Indoor Spring Radon and Tcgammaura for Mather Gorge Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.094	1	64.094	3.154	.077[a]
	Residual	7518.839	370	20.321		
	Total	7582.933	371			

a. Predictors: (Constant), AERO
b. Dependent Variable: SPRINGRAD

As shown in Figure 41 and Table 37, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that aeroradioactivity has very little correlation with summer radon values. The R-squared is 0.004 and means that approximately 0.4% percent of the variance of indoor summer radon is accounted for, or predicted by aeroradioactivity for the Mather Gorge Formation homes.



P > 0.05 (Not Significant)

Figure 41: Scatter Plot of Indoor Summer Radon and Aeroradioactivity for Mather Gorge Formation Homes

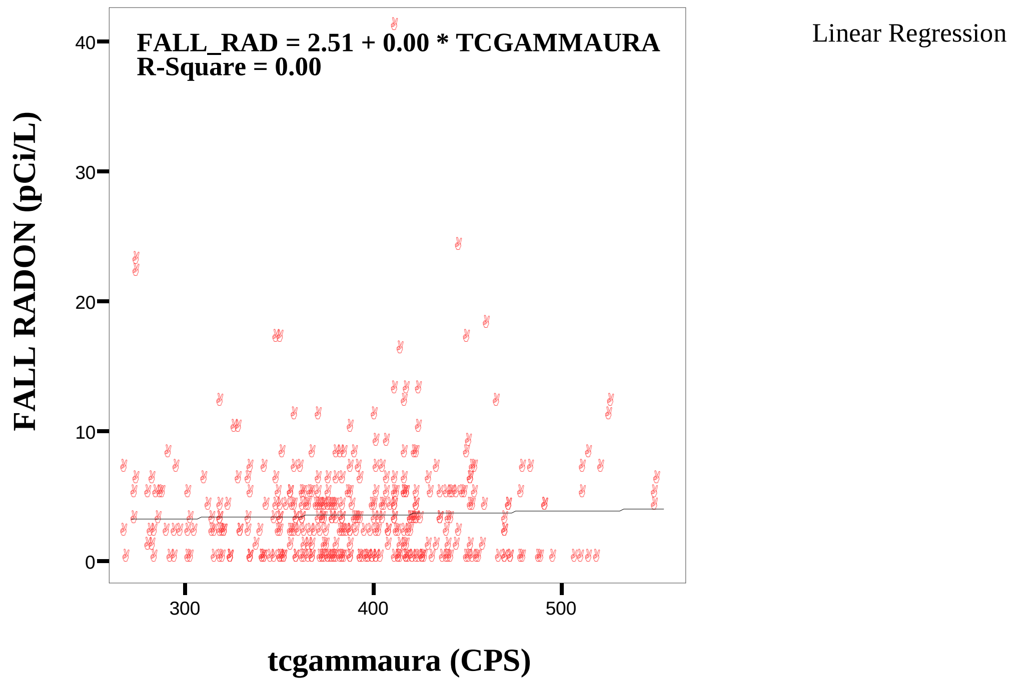
Table 37: Regression Output for Indoor Summer Radon and Tcgammaura for Mather Gorge Formation Homes

ANOVA[b]

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	10.259	1	10.259	1.315	.252[a]
	Residual	2887.214	370	7.803		
	Total	2897.473	371			

a. Predictors: (Constant), AERO
b. Dependent Variable: SUMMERRAD

As shown in Figure 42 and Table 38, the F-test is not statistically significant, which means that the model is not statistically significant. That is, we are 95% confident that aeroradioactivity has very little correlation with fall radon values. The R-squared is 0.001 and means that approximately 0.1% percent of the variance of indoor fall radon is accounted for, or predicted by aeroradioactivity for the Mather Gorge Formation homes.



P > 0.05 (Not Significant)

Figure 42: Scatter Plot of Indoor Fall Radon and Aeroradioactivity for Mather Gorge Formation Homes

Table 38: Regression Output for Indoor Fall Radon and Tcgammaura for Mather Gorge Formation Homes

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.838	1	8.838	.492	.484[a]
	Residual	6651.410	370	17.977		
	Total	6660.247	371			

a. Predictors: (Constant), AERO
b. Dependent Variable: FALLRAD

In summary, these comparisons all suggest that aeroradioactivity tends slightly to increase with indoor radon. This is supported by the fact that the regression outputs show the associations between aeroradioactivity and seasonal radon for the Sykesville Formation homes are statistically significant, but the associations between seasonal radon for the Pope's Head Formation homes are not statistically significant. In the case of the associations between aeroradioactivity and seasonal radon for the Mather Gorge Formation homes, only winter radon is statistically significant.

When all of the characteristics of radon (i.e., radon as a function of elevation, slope, aeroradioactivity and latitude and longitude) are included in the regression (Appendix 8D), the results show high-enough significant F-test values and the t-test values in most places. The combined models seem to be a better indication of what the single regressor models in Figures 21 – 42 and Tables 21 – 38 are trying to portray. However, aeroradioactivity cannot be used to identify areas of high (or low) indoor radon potential sufficiently well to be used to create high confidence radon potential maps. It could, at best, be used as a trend in predicting indoor radon.

VIII. DISCUSSION

Geostatistical techniques are commonly used to map a range of environmental variables, and particularly to generate probability maps of exceeding a given threshold. However, very few case studies have been published in which indoor radon measurements have been investigated using geostatistical techniques. The approach taken in this research was to examine comparisons between indoor radon data and location, and with geotechnical data. The results were used to determine if there is a relationship between indoor radon and geology, slope, elevation, and aeroradioactivity, and to determine if these geotechnical data could be used to create indoor risk maps.

The Section II study was a standard ellipse and trend analysis, which revealed a northwest to southeast decreasing trend in indoor radon measurements, and an east to west increasing trend. This tendency for indoor radon to be greater in some parts of Fairfax County was investigated by comparing indoor radon over different geological units in homes constructed on different slopes, on sites at different elevations, and over areas of different aeroradioactivity.

Section III explained the geological units in Fairfax County. Section IV used descriptive statistics to compare indoor radon in homes built over particular geological units with indoor radon in homes built over other units. In the three units that were selected for study because they have many indoor radon measurements, a statistical analysis of the distribution of measurements in these units showed that there is considerable overlap, and that a radon risk map of high confidence could not be based on the location of the geological units.

Sections V and VI were tests of the possibility that slope and elevation influence radon emanation. It was found that indoor radon levels tend to be higher in homes built on lower slope and in homes at lower elevations. Unfortunately, a radon risk map of high confidence could not be based on the homesite slope or elevation.

Section VII was a test of the possibility that aeroradioactivity could be correlated with indoor radon. The study found that aeroradioactivity tends to be only slightly greater in areas with greater indoor radon, so a radon risk map of high confidence could not be based on aeroradioactivity. Indoor radon only has a weak positive correlation with aeroradioactivity.

IX. CONCLUSIONS

This research sought to evaluate the possibility that on a county-size scale, there might be some predictability to indoor radon. In northern Virginia, Fairfax County was used because there are more radon measurements available for this one county than any other county in North America. The study quantified the indoor radon spatial autocorrelations between geology, slope, elevation and aeroradioactivity. There is a tendency for indoor radon to be greater in some parts of Fairfax County in homes on some geological units, in homes constructed on lower slopes, on sites at lower elevations, and in areas of higher aeroradioactivity. However, none of these physical variables exhibits a strong enough control on indoor radon to be used to construct radon potential maps that carry a high confidence of accuracy. That is, the combined characteristics associated with the emanation of indoor radon show that indoor radon measurements are not homogeneous across the study area in northern Virginia.

Few studies of any area in North America have used the geostatistical and three-dimensional visualization approach to investigate the association between seasonal indoor radon and geological unit, elevation, slope, and aeroradioactivity. In this area, or any area, the evaluation of the relationship between indoor radon and geotechnical data might be improved by using coded and digitized geology, more radon data, and better maps amendable to geostatistical analysis. However, at the present time, it appears that in this part of northern Virginia, geotechnical knowledge is apparently not useful in making maps that can be used to delineate areas of lower than average, or higher than average indoor radon.

APPENDICES

Appendix 1: Explanation of Abbreviations in the Appendix

ABBREVIATION	MEANING
STREET	Geocoded Street Address
ZIP	Postal Zip Code
WINT RAD,WINTER RAD	Winter Indoor Radon
SPR, SPRNG RAD, SPRING RAD	Spring Indoor Radon
SUM RAD,SUMR RAD, SUMMER RAD	Summer Indoor Radon
FAL RAD, FALL RAD	Fall Indoor Radon
AV, AVG	Average Indoor Radon
AERO	Aeroradioactivity
GEO1, GEO	VA Geological Unit
pCi/L	Pico Curies per Liter
HOME NO.	Home Number
ST	State

Appendix 2: Attribute Table for Seasonal Indoor Radon Measurements- Fairfax County, Virginia

STREET	TOWN	ZIP	WINT RAD	SPR RAD	SUM RAD	FAL RAD	AVG	AERO	GEO1
Alverton Street	Lorton	22079	2	2	2	2	2	331	QTu
Wessyn-ton Way	Alexa-ndria	22309	2	2	2	3	2	242	QTw
Robert-son Boule-vard	Alexa-ndria	22309	1	1	1	1	1	255	QTw
Braddock Ave.	Alexa-ndria	22309	7	7	8	9	8	217	QTw
Marconi Court	Spring-field	22153	3	2	0	2	2	254	Kp
Sheffield Village Ln	Lorton	22079	2	1	0	0	1	235	Kp
Godol-phin Drive	Spring-field	22153	6	6	4	6	5	243	Kp
Rockdale Lane	Spring-field	22153	2	3	2	3	3	237	Kp
Shade-way Place	Spring-field	22153	5	4	4	5	4	239	Kp
Marconi Court	Spring-field	22153	0	0	0	4	4	254	Kp
South-wood Road	Alexa-ndria	22309	3	1	1	0	2	253	Kp
Menard Court	Alexa-ndria	22309	6	4	3	3	4	251	Kp
Buckman Road	Alexa-ndria	22309	1	2	2	3	2	195	Kp
Amkin Drive	Clifton	22024	7	5	6	0	6	329	mg
Caledonia Street	Alexa-ndria	22309	2	1	2	1	2	278	Qsh
Orville	Alexa-	22309	6	3	3	3	4	299	Qsh

Street	ndria								
Karl Road	Alexa-ndria	22308	4	3	3	4	3	229	Qsh
Water-ford Road	Alexa-ndria	22308	2	1	1	2	1	145	Qsh
Traies Court	Alexa-ndria	22306	10	9	4	6	7	251	Qsh
Culpep-per Road	Alexa-ndria	22308	2	1	2	2	2	262	Qsh
Dane-wood Drive	Alexa-ndria	22308	6	6	4	5	5	243	Qsh
Crown Court Road	Alexa-ndria	22308	2	0	1	2	2	238	Qsh
Sherwood Hall Lane	Alexa-ndria	22306	2	0	1	1	1	264	Qsh
Clifton Farm Court	Alexa-ndria	22306	0	0	1	2	1	277	Qsh
Battery Road	Alexa-ndria	22308	2	2	2	3	2	238	Qsh
Mount Vernon Lane	Alexa-ndria	22309	0	0	0	0	0	355	Qsh
Traies Ct	Alexa-ndria	22306	2	2	2	2	2	251	Qsh
Ballston Drive	Spring-field	22153	3	1	1	1	1	234	psg
Sleepy View Lane	Spring-field	22153	1	1	1	2	1	219	psg
Powder-brook Lane	Spring-field	22153	1	1	1	1	1	218	psg
Edin-burgh Drive	Spring-field	22153	1	0	1	2	1	227	psg
Rebecca Drive	Alexa-ndria	22307	3	2	2	4	3	167	Tb1
Chillum Court	Spring-field	22153	2	0	1	2	2	193	O[o
Terra	Spring-	22153	1	0	1	2	1	212	O[o

Woods Drive	field								
Lobelia Lane	Spring-field	22152	3	2	2	3	3	263	[Zl
Vervain Ct	Spring-field	22152	3	3	2	3	3	354	[Zl
Barnack Drive	Spring-field	22152	3	2	3	3	3	307	[Zl
Barnack Drive	Spring-field	22152	0	0	0	0	0	307	[Zl
Greeley Blvd.	Spring-field	22152	2	2	2	3	2	346	[Zl
Harwood Place	Spring-field	22152	2	2	4	2	3	366	[Zl
Reynard Drive	Spring-field	22152	16	13	4	8	10	326	[Zl
Game Lord Drive	Spring-field	22153	3	6	9	9	7	268	[Zl
Madley Court	Spring-field	22152	10	6	4	7	7	337	[Zl
Etta Drive	Spring-field	22152	3	0	1	3	2	333	[Zl
Syden-stricker Road	Spring-field	22152	1	0	1	1	1	310	[Zl
Syden-stricker Road	Spring-field	22152	0	0	1	0	1	312	[Zl
Etta Drive	Spring-field	22152	1	1	2	1	1	330	[Zl
Bear Court	Spring-field	22153	5	3	6	6	5	274	[Zl
Reynard Drive	Spring-field	22152	7	7	0	3	6	305	[Zl
Vervain Court	Spring-field	22152	2	1	0	0	2	349	[Zl
Flax Street	Spring-field	22152	1	1	1	2	1	253	[Zl
Reynard Dr	Spring-field	22152	0	0	0	0	0	305	[Zl
Brim-stone	Fairfax Stati	22038	0	0	0	0	0	234	O[o

Lane									
Ryanlynn Drive	Fairfax Stati	22039	0	0	0	0	0	217	O[o
Clifton Hunt Lane	Clifton	22024	0	0	0	0	0	190	O[o
Pepper Lane	Clifton	22024	0	0	0	0	0	279	O[o
Corral Drive	Fairfax Stati	22039	0	0	0	0	0	273	O[o
Hender-son Road	Clifton	22024	0	0	0	0	0	338	O[o
Bonnie Mill Lane	Spring-field	22150	3	2	1	2	2	317	psg
Ridgeway Drive	Spring-field	22150	25	29	8	18	20	325	psg
Ridgeway Drive	Spring-field	22150	4	1	3	3	3	325	psg
Hanover Ave.	Spring-field	22150	3	2	3	3	3	313	msg
Jane Way	Alexa-ndria	22310	2	5	1	1	2	271	psg
Wood-field Estates Dr	Alexa-ndria	22310	1	1	1	1	1	263	psg
Lofthill Court	Alexa-ndria	22303	0	2	1	2	2	275	psg
Flaxton Place	Alexa-ndria	22303	2	3	2	3	3	282	psg
Wake Forest Drive	Alexa-ndria	22307	2	1	1	1	1	248	al
West-grove Blvd.	Alexa-ndria	22307	3	2	2	3	2	224	al
Skipton Court	Centr-eville	22020	6	6	4	5	5	473	S
Skipton Court	Centr-eville	22020	6	5	5	6	5	473	S
Klimt Court	Burke	22015	6	6	5	2	5	254	[i
Tilia Ct	Burke	22015	2	3	3	0	3	275	[i

Vandola Court	Burke	22015	1	1	1	2	1	238	[i
Tinsmith Lane	Burke	22015	2	2	3	3	2	237	[i
Kenil-worth Drive	Burke	22015	0	0	0	0	0	248	[i
Wigfield Way	Burke	22015	3	4	3	5	4	286	[i
Wigfield Way	Burke	22015	0	0	0	3	3	286	[i
Capella Avenue	Burke	22015	2	2	2	2	2	245	[i
Clydes-dale Rd.	Spring-field	22151	3	2	2	4	2	263	[i
Kemp Lane	Burke	22015	5	3	4	5	4	279	[i
Drayton Lane	Spring-field	22151	5	2	1	3	3	216	[i
Flint Tavern Place	Burke	22015	4	3	2	4	3	247	[i
Covered Bridge Road	Burke	22015	2	1	1	1	1	255	[i
Old Black-smith Drive	Burke	22015	2	1	1	1	1	244	[i
Vandola Court	Burke	22015	1	2	1	2	2	237	[i
Cromwell Drive	Spring-field	22151	0	0	0	0	0	211	[i
Orange Hunt Lane	Anna-ndale	22003	3	3	3	3	3	240	[i
Bloom Court	Burke	22015	4	3	4	5	4	278	[i
Parliment Drive	Burke	22015	0	1	1	0	1	239	[i
English Drive	Anna-ndale	22003	3	3	3	3	3	249	[i
English	Anna-	22003	3	2	2	1	2	249	[i

Drive	ndale								
Jerell Court	Burke	22015	6	5	7	9	7	333	[i
Bloom Court	Burke	22015	4	8	8	6	6	280	[i
Parlia-ment Drive	Burke	22015	7	8	3	6	6	229	[i
Byron Terrace	Burke	22015	4	4	3	3	3	287	[i
Point Long-street Way	Burke	22105	1	1	1	1	1	249	[i
English Drive	Anna-ndale	22003	3	3	2	3	3	249	[i
Piccadilly Place	Spring-field	22151	2	3	3	2	2	228	[i
Doolittle Street	Burke	22015	7	6	3	6	5	267	[i
Lyon Park Court	Burke	22015	3	4	5	5	4	227	[i
Peregrine Drive	Burke	22015	1	1	0	2	1	308	[i
Covered Bridge Road	Burke	22015	3	3	2	5	3	259	[i
Fitzhugh Street	Burke	22015	3	3	3	2	3	274	[i
Cromwell Drive	Spring-field	22151	1	1	2	1	1	201	[i
Signal Hill Drive	Burke	22015	5	5	4	3	4	230	[i
Braddock Road	Burke	22015	0	0	0	0	0	382	[i
Victoria Rd	Springf ld	22151	2	2	4	4	3	201	[i
Jackson Street	Burke	22015	0	0	0	0	0	308	[i
Lyon Park	Burke	22180	1	1	1	1	1	227	[i

Court									
English Drive	Anna-ndale	22003	1	1	1	1	1	249	[i
Signal Hill Dr	Burke	22015	1	0	0	0	1	230	[i
Navaho Drive	Alexa-ndria	22312	2	2	1	2	2	156	Psg
Rustle Ridge Ct	Fairfax Stati	22039	2	2	2	2	2	253	O[o
Beach-way Lane	Spring-field	22153	2	1	1	2	1	246	O[o
Estaban Place	Spring-field	22151	6	1	1	1	2	265	O[o
Wagon Trail Lane	Spring-field	22153	2	3	2	2	2	222	O[o
Shady Cove Drive	Fairfax Stati	22039	5	3	3	4	4	220	O[o
Fisher-man's Lane	Spring-field	22153	3	2	2	0	2	217	O[o
Shadow Lane	Fairfax Stati	22039	4	4	3	5	4	254	O[o
Spring Valley Drive	Alexa-ndria	22312	3	2	3	0	3	185	O[o
Frost Crystal Court	Fairfax Stati	22039	3	3	0	3	3	247	O[o
Murillo Street	Spring-field	22151	0	2	2	5	3	266	O[o
Murillo Street	Spring-field	22033	0	3	0	0	3	266	O[o
Murillo Street	Spring-field	22033	3	0	0	0	3	257	O[o
Murillo Street	Spring-field	22033	0	0	0	0	0	267	O[o
Elgar Street	Spring-field	22151	1	1	1	1	1	188	O[o
Carath Court	Spring-field	22153	2	1	1	2	1	195	O[o
Hunts-	Spring-	22153	2	0	0	0	2	219	O[o

man Boule-vard	field								
Cutter-mill Place	Spring-field	22153	1	1	1	1	1	220	O[o
Arley Drive	Spring-field	22153	2	1	2	0	2	228	O[o
Sedge-wick Lane	Spring-field	22151	4	2	2	2	2	253	O[o
Hooes Road	Spring-field	22153	5	4	4	3	4	279	O[o
Viceroy Street	Spring-field	22151	6	6	7	7	6	235	O[o
Maple Tree Lane	Spring-field	22152	3	3	5	4	4	282	O[o
Gresham Street	Spring-field	22151	5	4	3	4	4	192	O[o
Gavel-wood Court	Spring-field	22153	4	5	2	0	4	215	O[o
Elgar Street	Spring-field	22151	0	1	1	2	1	189	O[o
Inver-chapel Road	Spring-field	22151	3	2	1	3	2	223	O[o
Chatham Street	N. Spring-field	22151	2	1	1	2	1	211	O[o
Timber-idge Road	Fairfax Stati	22039	2	3	4	2	3	229	O[o
Alberta Street	Spring-field	22152	2	3	2	3	2	343	O[o
Carrleigh Parkway	Spring-field	22152	3	2	4	3	3	325	O[o
Eddy Bend Trail	Fairfax Stati	22039	3	0	1	2	2	242	O[o
Uxbridge Court	Spring-field	22151	0	0	1	0	1	241	O[o
Shamrock	Spring-	22152	1	1	2	1	1	271	O[o

Court	field								
Ains-worth Avenue	Spring-field	22152	1	0	1	1	1	357	O[o
Rocky Ravine Drive	Fairfax Stati	22039	2	3	1	2	2	267	O[o
Hamlet Street	Sping-field	22151	2	0	1	2	2	267	O[o
Gambrill Lane	Spring-field	22153	5	6	4	7	5	262	O[o
Wood-chase Drive	Fairfax Stati	22039	2	3	2	2	2	274	O[o
Bradford Drive	Anna-ndale	22003	4	0	2	3	3	241	O[o
Spur Road	Spring-field	22152	4	4	3	4	4	308	O[o
Maritime Lane	Spring-field	22153	2	3	2	3	3	206	O[o
Axton Street	Spring-field	22151	1	4	1	2	2	206	O[o
Axton Street	Spring-field	22151	0	1	0	0	1	213	O[o
Ship-wright Drive	Burke	22015	2	2	1	2	2	246	O[o
Middle Valley Drive	Spring-field	22153	3	5	3	4	4	243	O[o
Marianna Court	Burke	22015	8	7	5	6	6	371	O[o
Passa-geway Place	Burke	22015	2	4	16	2	6	309	O[o
Barnack Drive	Spring-field	22152	3	2	2	3	2	309	O[o
Gralnick Place	Spring-field	22153	5	4	3	3	4	206	O[o
Taunton Place	Spring-field	22152	2	2	1	1	2	275	O[o
Gavel-wood	Spring-field	22153	2	0	3	3	3	216	O[o

Court									
Brompton Street	Spring-field	22152	2	2	2	1	2	347	O[o
Westbury Oaks Court	Burke	22015	1	1	1	2	1	286	O[o
Joshua Tree Lane	Spring-field	22152	2	0	3	5	4	309	O[o
Hunts-man Boule-vard	Spring-field	22152	1	2	1	2	1	303	O[o
Kenwood Avenue	Spring-field	22152	3	3	3	4	3	243	O[o
Park Point Court	Fairfax Stati	22039	2	0	2	2	2	275	O[o
Old Oaks Drive	Spring-field	22152	3	2	2	2	2	368	O[o
Paloma Court	Spring-field	22153	2	1	1	2	1	203	O[o
Tree Hollow Court	Fairfax Stati	22039	4	5	6	6	5	269	O[o
Banyon Ridge Rd.	Fairfax Stati	22039	2	3	3	4	3	222	O[o
Murillo St.	Spring-field	22151	0	0	0	0	0	266	O[o
Sampal Place	Spring-field	22153	3	0	4	4	4	296	O[o
Loudoun Lane	Spring-field	22152	1	2	2	2	2	337	O[o
Wooden Spoke Ct	Burke	22015	2	3	2	3	3	241	O[o
Catlett St.	Spring-field	22151	0	2	2	2	2	239	O[o
Hooes Road	Spring-field	22153	3	3	4	5	4	279	O[o
Jaydee	Fairfax Stati	22039	1	3	1	2	2	246	O[o
Rocky Ravine	Fairfax Stati	22039	9	9	5	8	8	267	O[o

Dr.									
East-bourne Dr.	Spring-field	22151	2	1	3	3	2	269	O[o
Waverly St	Linc-olnia	22312	2	2	3	3	2	191	O[o
Mountain Valley Rd	Fairfax Stati	22039	0	1	2	2	2	223	O[o
Beaver Pond Court	Fairfax Stati	22039	0	0	0	0	0	251	O[o
Mountain Valley Road	Fairfax Stati	22039	0	0	0	0	0	246	O[o
Dominion Valley Drive	Fairfax Stati	22039	0	0	0	0	0	213	O[o
Mountain Valley Road	Fairfax Stati	22039	0	0	0	0	0	223	O[o
Dominion Valley Dr.	Fairfax Stati	22039	0	0	0	0	0	213	O[o
Ginger-bread Lane	Fairfax Stati	22039	0	0	0	0	0	249	O[o
Dublin Avenue	Spring-field	22151	3	1	2	2	2	210	Kp
Kingston Drive	Anna-ndale	22003	3	2	3	3	2	216	Kp
Laurel Glen Road	Clifton	22024	3	3	3	5	4	292	[Zms
Laurel Glen Road	Clifton	22024	1	1	2	2	1	287	[Zms
Clifton Road	Clifton	22024	0	0	0	0	0	339	[Zms
Strong Spring Court	Anna-ndale	22003	4	4	4	0	4	295	O[f
Trotting	Anna-	22003	0	3	2	1	2	287	O[f

Lane	ndale									
Sawgrass Court	Alexa-ndria	22312	1	0	1	1	1	286	O[o	
Roberts Avenue	Anna-ndale	22003	2	2	2	2	2	253	Msg	
Watkins Trail	Anna-ndale	22003	1	0	1	2	1	260	Msg	
Wood-ridge Road	Alexa-ndria	22312	6	0	5	5	5	270	Msg	
Marshall Pond Rd	Burke	22015	3	2	2	1	2	359	[sv	
Bunker Woods Lane	Burke	22015	3	3	3	2	3	378	[sv	
Wood Sorrel Lane	Burke	22015	2	2	3	3	3	387	[sv	
Wilmette Drive	Burke	22015	6	6	4	7	6	355	[sv	
Lincoln-wood Drive	Burke	22015	20	17	13	13	16	458	[sv	
Marqu-and Drive	Burke	22015	7	6	7	7	7	335	[sv	
Bronte Drive	Fairfax	22032	6	5	7	10	7	398	[sv	
Wood Laurel Court	Burke	22015	0	3	4	4	4	399	[sv	
Eagle Landing Court	Burke	22015	3	2	2	2	2	266	[sv	
Winter-way Lane	Fairfax Stati	22039	2	0	2	2	2	208	[sv	
Eastwood Court	Fairfax	22032	6	0	6	6	6	346	[sv	
Wythal Lane	Burke	22015	1	1	1	1	1	394	[sv	
Kathar-ines Drive	Burke	22015	1	0	2	3	2	197	[sv	
Falcon	Burke	22015	4	4	4	5	4	275	[sv	

Lnd. Ct.									
Heritage Landing Rd	Burke	22015	4	0	4	3	4	266	[sv
Eagle Landing Road	Burke	22015	2	2	2	2	2	274	[sv
Natick Road	Burke	22015	4	0	4	6	5	456	[sv
Heritage Landing Ct.	Burke	22015	1	1	1	1	1	266	[sv
Wolf Run Shoals Road	Fairfax Stati	22039	1	2	2	3	2	207	[sv
Wolf Run Shoals Road	Fairfax Stati	22039	1	0	4	5	4	257	[sv
Martins Landing Ct	Burke	22015	0	0	1	0	1	286	[sv
Babson Court	Fairfax	22032	2	1	1	0	1	325	[sv
Lake-pointe Dr	Burke	22015	4	0	0	0	4	364	[sv
Willow-brook Rd.	Fairfax	22039	3	5	4	5	4	206	[sv
Four Oaks Lane	Burke	22015	0	5	8	0	6	227	[sv
Natick Road	Burke	22015	13	9	6	8	9	448	[sv
Westport Lane	Burke	22015	9	0	8	8	8	372	[sv
Split Rail Lane	Fairfax Stati	22039	0	0	2	0	2	241	[sv
Sylvan Glen Lane	Fairfax Stati	22039	0	0	0	0	0	224	[sv
Sylvan Glen Lane	Fairfax Stati	22039	0	0	0	0	0	224	[sv
Sylvan	Fairfax	22039	0	0	0	0	0	224	[sv

Glen Lane	Stati								
Split Rail Lane	Fairfax Stati	22039	0	0	0	0	0	240	[sv
Wolf Run Shoals Road	Fairfax Stati	22039	2	1	2	3	2	200	[sv
Lincoln-wood Drive	Burke	22015	1	1	2	1	1	458	[sv
King Richard Drive	Anna-ndale	22003	2	2	1	2	2	303	[Zl
Wind-flower Lane	Anna-ndale	22003	4	6	2	4	4	336	[Zl
Wind-flower Lane	Anna-ndale	22003	0	0	0	0	0	336	[Zl
King Richard Drive	Anna-ndale	22003	3	4	2	2	3	263	[Zl
Tarheel Way	Anna-ndale	22003	2	0	1	2	2	268	[Zl
King David Blvd.	Anna-ndale	22003	3	1	1	1	1	317	[Zl
King Richard Dr.	Anna-ndale	22003	8	2	8	11	7	303	[Zl
Wind-flower Lane	Anna-ndale	22003	0	3	5	4	4	336	[Zl
Wind-flower Lane	Anna-ndale	22003	19	3	1	10	8	336	[Zl
Century Court	Alexa-ndria	22312	1	0	2	0	1	249	Psg
Century Court	Alexa-ndria	22312	0	0	0	0	0	249	Psg
N. Morgan Street	Alexa-ndria	22312	3	3	1	2	2	185	Psg

N. Chambliss Street	Alexandria	22312	4	2	2	2	2	202	Psg
Dakota Court	Alexandria	22312	2	2	2	2	2	219	Psg
Dahill Place	Alexandria	22312	3	2	4	4	3	223	Psg
N. Fairfax Street	Alexandria	22314	23	13	7	8	13	243	Qsh
Royce Court	Annandale	22003	4	2	2	3	2	339	[Zl
Walton Lane	Annandale	22003	6	0	5	0	5	334	[Zl
Tollgate Terrace	Falls Church	22041	3	2	0	3	2	105	Water
River Drive	Lorton	22079	0	1	1	1	1	112	Water
Whitman Road	Annandale	22003	2	2	3	3	2	341	O[f
Ridgelea Drive	Fairfax	22031	1	1	1	2	1	303	O[f
Hollinwood Drive	Alexandria	22307	3	3	2	2	2	168	Kp
Hackberry Street	Springfield	22150	3	1	1	2	2	211	Kp
Swan Terrace	Alexandria	22307	0	1	1	2	1	237	Kp
Ridge View Dr	Alexandria	22310	2	2	1	0	2	246	Kp
Courtland Road	Alexandria	22306	7	6	4	7	6	234	Kp
Forest Hill Road	Alexandria	22307	7	1	3	4	4	232	Kp
Martha's Road	Alexandria	22307	3	3	2	3	2	154	Kp
Priscilla Lane	Alexandria	22308	2	1	1	1	1	245	Kp
Rebecca Lane	Alexandria	22307	6	4	7	6	5	150	Kp
Eaton Place	Alexandria	22310	5	6	4	5	5	285	Kp

Cyrus Place	Alexa-ndria	22308	2	1	2	2	2	247	Kp
Westfield Court	Alexa-ndria	22306	0	0	1	2	1	293	Kp
Greenleaf Street	Spring-field	22150	3	3	2	3	3	234	Kp
Cotton-wood Drive	Alexa-ndria	22310	9	7	7	8	8	267	Kp
Martha's Road	Alexa-ndria	22307	3	3	2	3	3	154	Kp
Gentle Lane	Alexa-ndria	22310	7	4	2	2	4	237	Kp
Popkins Lane	Alexa-ndria	22307	2	1	1	2	1	161	Kp
Memorial Street	Alexa-ndria	22310	4	0	2	4	3	266	Kp
Potomac Lane	Alexa-ndria	22308	0	1	2	2	1	252	Kp
Eaton Place	Alexa-ndria	22310	2	2	2	3	2	272	Kp
Felton Lane	Alexa-ndria	22308	3	3	2	2	2	242	Kp
Upland Drive	Alexa-ndria	22310	13	0	3	2	6	293	Kp
Lake Cove Drive	Alexa-ndria	22310	0	0	1	1	1	336	Kp
d'Evereux Circle Dr	Alexa-ndria	22310	1	1	2	2	1	341	Kp
Riefton Court	Alexa-ndria	22310	2	2	1	2	2	255	Kp
Madison Hill Court	Alexa-ndria	22310	1	0	1	1	1	256	Kp
Yale Drive	Alexa-ndria	22307	3	0	3	3	3	247	Kp
Bolling Drive	Alexa-ndria	22308	1	1	1	2	2	212	Kp
Midday Lane	Alexa-ndria	22306	3	2	2	3	3	225	Kp
Martha's Road	Alexa-ndria	22307	2	2	2	2	2	158	Kp

Forest Hill Road	Alexa-ndria	22307	2	1	1	1	1	232	Kp
Seminary Rd, T-11-S	Falls Church	22041	7	2	8	9	7	245	Psg
Bouffant Blvd.	Alexa-ndria	22311	0	3	4	4	3	265	Psg
Greentree Drive	Falls Church	22041	6	4	3	4	4	276	[i
Medford Drive	Anna-ndale	22003	2	1	1	3	2	271	[i
Lakeview Drive	Falls Church	22041	5	3	3	0	4	200	[i
Sleepy Hollow Road	Anna-ndale	22003	2	2	3	3	2	236	[i
Burton Circle	Falls Church	22041	5	3	4	5	4	199	[i
Burton Circle	Falls Church	22041	3	3	4	3	3	199	[i
Munson Hill Road	Falls Church	22044	8	9	8	6	8	304	[i
Duff Drive	Falls Church	22041	2	2	2	3	2	205	[i
Dearborn Drive	Falls Church	22044	2	2	2	3	2	268	[i
Colfax Avenue	Alexa-ndria	22311	1	0	1	1	1	218	[i
Meeting Street	Falls Church	22044	1	0	1	4	2	298	[i
Edan Mae Court	Anna-ndale	22003	1	1	2	2	1	248	[i
Beach-way Drive	Falls Church	22041	0	0	0	0	0	291	[i
Jayhawk Street	Anna-ndale	22003	2	0	1	2	1	236	[i
Lock-wood Lane	Anna-ndale	22003	3	3	4	5	4	299	[i
Tunlaw Street	Alexa-ndria	22312	0	0	2	2	2	259	[i

Greentree Drive	Falls Church	22041	0	0	1	1	1	276	[i
Lakeview Dr	Falls Church	22041	5	3	2	3	3	226	[Zl
Cross-woods Dr	Falls Church	22044	4	2	2	2	3	247	[Zl
Brook Drive	Falls Church	22044	5	4	5	7	5	319	[Zl
Home-spun Lane	Falls Church	22044	2	3	2	3	3	231	[Zl
Queen Anne Terrace	Falls Church	22044	2	1	2	0	1	248	[Za
Eppard Street	Falls Church	22044	5	4	4	4	4	302	[Za
Lily Dhu Lane	Falls Church	22044	2	0	0	0	2	273	[Za
Patrick Henry Drive	Falls Church	22044	3	3	2	2	2	267	[Za
Creswell Drive	Falls Church	22044	7	9	4	4	6	330	[Za
Overhill Road	Falls Church	22042	2	2	3	7	3	334	[Za
Juniper La	Falls Church	22044	10	6	12	13	10	302	[Za
Byrd Drive	Fairfax City	22030	6	4	2	3	4	366	[sv
Farr Avenue	Fairfax	22030	5	5	5	2	4	389	[sv
Crest Street	Fairfax	22030	3	3	5	5	4	344	[sv
Crest Street	Fairfax	22030	0	0	0	0	0	344	[sv
Pappas Way	Anna-ndale	22003	3	1	1	2	2	322	[Za
King Richard Dr	Anna-ndale	22003	3	1	1	1	2	304	[Za
Willow Woods Dr	Anna-ndale	22003	7	31	2	4	11	297	[Za

Reedy Drive	Anna-ndale	22003	4	5	1	4	4	406	[Za
Reedy Drive	Anna-ndale	22003	3	3	2	5	3	406	[Za
Reedy Drive	Anna-ndale	22003	0	0	0	0	0	406	[Za
Taleen Court	Anna-ndale	22003	3	3	1	4	3	391	[Za
Willow Woods Drive	Anna-ndale	22003	2	2	2	1	2	300	[Za
Highland Lane	Fairfax	22031	31	29	5	6	18	358	[Za
Glaston-bury Court	Anna-ndale	22003	6	2	3	4	4	384	[Za
Starr Jordan Drive	Anna-ndale	22003	6	4	4	6	5	367	[Za
Holborn Avenue	Anna-ndale	22003	5	4	4	5	5	320	[Za
Hayden Lane	Anna-ndale	22003	1	1	1	1	1	403	[Za
Reedy Drive	Anna-ndale	22003	5	4	2	4	3	413	[Za
Ashford Lane	Fairfax	22032	3	6	5	4	4	353	[Za
Highland Lane	Fairfax	22031	15	11	9	6	10	358	[Za
Ararat Court	Anna-ndale	22003	22	11	14	14	15	387	[Za
Selkirk Drive	Fairfax	22032	2	2	3	4	3	351	[Za
Mynor Drive	Anna-ndale	22003	17	13	4	4	9	369	[Za
Ordinary Way	Anna-ndale	22003	7	6	4	5	5	323	[Za
The Midway	Anna-ndale	22003	5	0	5	6	5	341	[Za
Briar Creek Drive	Anna-ndale	22003	5	5	2	5	4	326	[Za
Lothbury	Fairfax	22031	3	1	3	3	2	324	[Za

Court									
Holborn Avenue	Anna-ndale	22003	3	3	5	5	4	367	[Za
Mt. Airey Lane	Anna-ndale	22003	1	0	2	1	1	370	[Za
High Point Court	Anna-ndale	22003	4	5	6	5	5	346	[Za
Raleigh Avenue	Anna-ndale	22003	3	3	2	3	3	324	[Za
Chapel Drive	Anna-ndale	22003	5	5	4	5	5	310	[Za
Reedy Drive	Anna-ndale	22003	0	1	1	1	1	413	[Za
Kristin Lane	Fairfax	22032	3	3	0	3	3	372	[Za
South-wick Street	Fairfax	22030	4	5	3	4	4	347	[Za
Holborn Ave.	Anna-ndale	22003	5	1	0	3	3	380	[Za
Ordinary Court	Anna-ndale	22003	2	3	3	3	3	335	[Za
Laurel Leaf Lane	Fairfax	22031	10	2	0	9	7	340	[Za
Ashford Lane	Fairfax	22032	4	3	4	5	4	346	[Za
Elizabeth Lane	Anna-ndale	22003	0	10	9	9	9	306	[Za
Valor Court	Anna-ndale	22003	3	4	3	2	3	359	[Za
Good-view Ct.	Fairfax	22031	1	1	1	1	1	358	[Za
Coles-bury Pl.	Fairfax	22031	5	4	3	5	4	335	[Za
Ordinary Way	Anna-ndale	22003	5	4	4	5	5	330	[Za
Mynor Drive	Anna-ndale	22003	1	2	3	2	2	369	[Za
Highland Lane	Fairfax	22031	7	5	6	6	6	358	[Za
Doveville	Fairfax	22302	0	0	0	0	0	325	[Za

Lane									
South-wick St	Fairfax	22031	0	0	0	0	0	347	[Za
Ararat Court	Anna-ndale	22003	1	0	2	1	1	387	[Za
Laurel Leaf Lane	Fairfax	22031	0	0	0	0	0	340	[Za
Highland Lane	Fairfax	22031	0	0	0	0	0	358	[Za
Ashford Lane	Fairfax	22032	0	0	0	0	0	346	[Za
Hazelton Street	Falls Church	22044	2	2	2	0	2	336	Msg
Nichol-son Street	Falls Church	22044	3	2	2	2	2	300	Msg
Triplett Drive	Centr-eville	22020	2	3	1	2	2	427	S
Triplett Drive	Centr-eville	22020	0	0	0	0	0	427	S
Jameson Court	Centr-eville	22020	7	10	11	16	11	467	S
Jameson Court	Centr-eville	22020	0	0	0	0	0	467	S
Baywood Court	Centr-eville	22020	0	2	2	3	2	350	S
Quail Pond Court	Centr-eville	22020	4	5	2	3	3	489	S
Antonia Ford Ct.	Centr-eville	22020	2	3	2	3	2	351	S
Indian Rock Rd	Centr-eville	22020	6	8	4	5	5	348	S
Cedar Break Drive	Centre-ville	22020	1	1	2	3	2	466	S
Union Village Cir.	Clifton	22024	2	2	1	1	1	248	[Zpb
Delsign-ore Drive	Fairfax	22030	5	6	4	5	5	240	[Zpb
Ashton Oaks	Fairfax	22030	3	4	2	5	3	281	[Zpb

Court									
Union Mill Road	Clifton	22024	0	2	1	1	1	245	[Zpb
Rock Flint Court	Clifton	22024	0	2	1	1	1	295	[Zpb
Bevan Drive	Fairfax	22030	1	1	0	1	1	257	[Zpb
Wilder Court	Clifton	22024	1	0	1	0	1	255	[Zpb
Rock Flint Court	Clifton	22024	2	0	1	2	2	295	[Zpb
Meath Drive	Fairfax	22030	1	0	2	2	2	401	[Zpb
Rose-haven Street	Fairfax	22030	3	2	0	2	2	286	[Zpb
Strath-more Street	Falls Church	22042	4	2	1	1	2	285	O[f
Kerns Rd	Falls Church	22042	2	1	3	3	2	272	O[f
Roase-mary Lane	Falls Church	22042	2	2	1	1	1	209	O[f
Brandy Court	Falls Church	22042	7	4	3	4	5	302	O[f
Timber Lane	Falls Church	22046	1	1	1	1	1	167	O[f
Slade Run Dr	Falls Church	22042	3	3	3	4	3	323	O[f
Holly Berry Court	Falls Church	22042	2	1	3	3	2	316	O[f
Marlo Drive	Falls Church	22042	2	2	1	1	2	261	O[f
Laura Drive	Falls Church	22046	2	1	1	1	2	230	O[f
Siesta Drive	Falls Church	22042	5	3	2	4	3	306	O[f
Fairwood	Falls	22046	4	1	1	1	2	179	O[f

Lane	Church								
Glenmont Street	Falls Church	22042	3	2	3	2	2	291	O[f
Rolfs Road	Falls Church	22042	2	1	1	1	1	316	O[f
Charles-ton Street	Anna-ndale	22003	2	2	1	2	2	312	O[f
Statecrest Drive	Anna-ndale	22003	2	2	2	2	2	312	O[f
Rogers Drive	Falls Church	22042	1	1	0	1	1	234	O[f
Strath-more Street	Falls Church	22042	1	1	1	2	1	285	O[f
Sheffield Court	Falls Church	22042	0	8	3	6	5	298	O[f
Marlo Drive	Falls Church	22042	3	4	5	5	4	248	O[f
Pine Spring Road	Falls Church	22042	1	1	1	1	1	254	O[f
Strath-meade Street	Falls Church	22042	1	1	1	0	0	227	O[f
Mann Court	Falls Church	22046	3	3	1	4	3	175	O[f
Holmes Run Road	Falls Church	22042	1	2	2	2	2	224	O[f
Krysia Court	Anna-ndale	22003	2	2	3	3	2	298	O[f
Kerns Road	Falls Church	22042	2	2	1	2	2	271	O[f
Mendota Avenue	Fairfax	22042	8	8	3	5	6	224	O[f
Clear-wood Ct	Falls Church	22042	5	7	7	6	6	267	O[f
Rosemary Lane	Falls Church	22042	4	6	3	4	4	187	O[f
Brandy Ct	Falls Ch	22042	1	1	0	0	1	302	O[f
Marlo Dr	Falls Ch	22042	3	2	1	1	2	248	O[f
Hideaway	Fairfax	22031	6	7	5	5	6	335	O[ps

Rd									
Acorn Circle	Vienna	22180	10	5	4	4	6	369	O[ps
Everleigh Way	Fairfax	22031	4	2	1	2	2	334	O[ps
Everleigh Way	Fairfax	22031	0	1	0	0	1	334	O[ps
Everleigh Way	Fairfax	22031	0	2	0	0	2	334	O[ps
Rumsey Place	Fairfax	22032	6	5	4	4	5	337	O[ps
Fairlee Drive	Fairfax	22031	0	2	2	2	2	316	O[ps
Paynes Church Drive	Fairfax	22032	26	25	3	7	15	331	O[ps
Tapestry Drive	Fairfax	22032	5	4	3	4	4	299	O[ps
Red Spruce Road	Fairfax	22032	10	7	4	7	7	284	O[ps
Clara Barton Drive	Fairfax Stati	22039	0	7	8	8	8	330	O[ps
Wilcox-son Drive	Fairfax	22031	1	1	1	1	1	340	O[ps
Hideway Road	Fairfax	22030	4	4	2	3	3	335	O[ps
Lenox Road	Fairfax	20032	7	0	4	4	5	364	O[ps
Clan-brook Court	Fairfax	22031	7	8	4	4	5	314	O[ps
Chapel Road	Clifton	22024	6	5	3	5	5	268	O[ps
White Rose Lane	Fairfax	22031	1	1	1	2	1	339	O[ps
Captain Rhett Lane	Fairfax Stati	22039	2	2	10	9	5	350	O[ps
Zion Drive	Fairfax	22032	0	0	0	0	0	400	O[ps

Paynes Church Drive	Fairfax	22032	1	1	2	2	1	332	O[ps
Colch-ester Rd.	Fairfax Stati	22039	9	7	6	9	7	356	O[ps
Red Spruce Dr.	Fairfax	22032	10	9	9	11	9	282	O[ps
Tapestry Dr	Fairfax	22032	1	1	1	1	1	299	O[ps
Hideaway Road	Fairfax	22031	1	0	1	2	1	335	O[ps
Paynes Chu-rch Dr	Fairfax	22032	10	6	2	4	6	331	O[ps
Tapestry Drive	Fairfax	22032	0	0	0	0	0	299	O[ps
Hunt Road	Oakton	22124	22	10	9	6	12	456	[Zmg
Hunt Road	Oakton	22124	8	6	5	4	6	456	[Zmg
Hunt Road	Oakton	22124	11	7	5	6	7	456	[Zmg
Hunt Road	Oakton	22124	0	3	3	5	4	440	[Zmg
Hunt Rd	Oakton	22124	1	1	1	1	1	456	[Zmg
Glencroft Road	Vienna	22180	4	5	5	0	5	266	[Zpb
Oak-ton Glen Drive	Vienna	22180	5	3	2	0	3	297	[Zpb
Black Oak Drive	Fairfax	22032	4	3	2	3	3	379	O[po
Groves Lane	Fairfax	22030	6	5	3	4	5	356	O[po
Sandy Folly Ct	Fairfax Stati	22039	5	6	6	6	6	399	O[po
Chestnut St. Box 29	Clifton	22024	7	6	4	5	5	325	O[po
Hamilton Drive	Fairfax	22031	6	4	2	3	4	324	O[po

Kelley Dr	Fairfax	22030	4	3	2	2	2	335	O[po
Pumphre y Drive	Fairfax	22032	3	3	3	4	3	298	O[po
St. Charles Place	Fairfax	22032	5	4	4	4	4	361	O[po
Locust Street SW	Vienna	22180	3	0	0	0	3	321	O[po
Kaywood Ct.	Fairfax	22032	5	3	2	1	3	323	O[po
Rockbrid ge Street	Vienna	22180	3	3	1	2	2	348	O[po
Rockbrid ge Street	Vienna	22180	0	0	0	0	0	348	O[po
Rockbrid ge Street	Vienna	22180	0	2	0	0	2	348	O[po
Rockbrid ge Street	Vienna	22180	0	44	0	0	44	348	O[po
Rockbrid ge Street	Vienna	22180	0	3	0	0	3	348	O[po
Brookwo od Drive	Fairfax	22030	5	4	4	5	4	443	O[po
Harmony Drive, SW	Vienna	22180	3	3	2	2	2	328	O[po
Redwood Drive	Vienna	22180	6	5	4	5	5	351	O[po
Sandy Folly Court	Fairfax Stati	22039	4	3	3	0	3	414	O[po
Old Creek Drive	Fairfax	22032	8	8	5	7	7	364	O[po
Coleridge Drive	Fairfax	22032	6	3	2	0	3	342	O[po
Barkley Drive	Fairfax	22031	8	9	7	9	8	297	O[po
Arrowoo d St.	Fairfax	22032	4	3	3	4	3	374	O[po
Tovito Drive	Fairfax	22031	0	1	1	3	2	318	O[po
Arrowoo	Fairfax	22032	2	1	1	1	2	374	O[po

d Street									
Minton Drive	Fairfax	22032	3	3	3	3	3	353	O[po
Fairhill Road	Fairfax	22031	4	5	2	3	3	360	O[po
Whitacre Road	Fairfax	22032	0	1	2	2	2	385	O[po
Southport Lane	Fairfax	22032	4	2	3	5	3	356	O[po
Loch Linden Court	Fairfax	22032	2	1	1	2	2	359	O[po
Yater Ford Road	Fairfax Stati	22039	7	6	5	6	6	303	O[po
Prince William Drive	Fairfax	22031	2	1	1	2	1	334	O[po
Herend Place	Fairfax	22032	0	2	0	0	2	383	O[po
Forest Avenue	Fairfax	22030	3	4	5	6	4	324	O[po
Fair-fax Station Rd.	Clifton	22024	8	6	3	3	5	378	O[po
Bel Glade Street	Fairfax	22031	0	2	2	0	2	343	O[po
Coronado Terrace	Fairfax	22031	2	3	3	4	3	364	O[po
Forest Avenue	Fairfax	22030	0	1	0	0	1	294	O[po
Pumphre y Drive	Fairfax	22032	0	8	27	0	17	279	O[po
Pump-hrey Drive	Fairfax	22032	0	0	0	0	0	277	O[po
Pump-hrey Drive	Fairfax	22032	0	0	0	0	0	277	O[po
Anchor Court	Fairfax	22032	2	3	3	2	3	312	O[po
Split Oak Lane	Burke	22015	1	1	0	2	1	302	O[po

Ware Street, S.W.	Vienna	22180	1	2	2	3	2	337	O[po
Hamilton Drive	Fairfax	22031	3	4	4	3	3	298	O[po
Common wealth Blvd.	Fairfax	22032	3	3	3	5	3	349	O[po
Old Creek Drive	Fairfax	22032	6	7	4	8	6	364	O[po
Old Creek Drive	Fairfax	22032	7	8	5	6	6	364	O[po
Common wealth Blvd.	Fairfax	22032	8	8	5	8	7	318	O[po
Stone-leigh Court	Fairfax	22031	6	5	4	5	5	318	O[po
Hamilton Drive	Fairfax	22031	3	3	1	3	2	302	O[po
Robert Carter Road	Fairfax Stati	22039	2	2	16	3	6	293	O[po
Barkley Drive	Fairfax	22031	3	2	1	2	2	316	O[po
Grovewo od Way	Fairfax	22032	3	2	3	3	3	325	O[po
St. Marks Place	Fairfax	22031	5	4	3	5	4	333	O[po
Queens Brigade Dr	Fairfax	22030	3	3	2	3	2	451	O[po
De-Quincy Drive	Fairfax	22032	5	5	5	5	5	344	O[po
Arrington Drive	Fairfax Stati	22039	12	12	9	10	11	299	O[po
Jackson Parkway	Vienna	22180	1	1	1	2	1	360	O[po
Ivakota Road	Clifton	22024	4	0	5	4	4	359	O[po

Hamilton Drive	Fairfax	22031	2	3	3	4	3	342	O[po
Pump-hrey Drive	Fairfax	22032	2	0	4	4	3	296	O[po
Oakland Park Drive	Burke	22015	3	4	5	5	4	309	O[po
Steam-boat Landing Ln	Burke	22015	5	4	5	4	4	297	O[po
Chapel View Road	Clifton	22024	9	0	8	7	8	264	O[po
Ayito Road, SE	Vienna	22180	1	1	1	1	1	359	O[po
St. Marks Place	Fairfax	22031	3	1	2	3	2	332	O[po
Univer-sity Drive	Fairfax	22030	1	0	1	2	1	317	O[po
Landon Court	Fairfax	22031	0	0	3	0	3	372	O[po
John Turley Place	Fairfax	22032	3	2	1	2	2	330	O[po
Fireside Court	Fairfax	22032	4	0	3	4	4	357	O[po
Cottage Street, SW	Vienna	22180	3	1	1	3	2	325	O[po
Reeds Landing Cir.	Burke	22015	8	0	5	6	7	297	O[po
Carter-wood Drive	Fairfax	22032	3	0	1	2	2	331	O[po
Calumet Grove	Fairfax	22032	6	0	4	6	5	364	O[po
Claridge Court	Fairfax	22032	2	3	3	3	3	302	O[po
Oak Leather	Burke	22015	3	0	3	2	3	311	O[po

Drive									
Briary Lane	Fairfax	22031	2	0	0	1	2	353	O[po
Caithness Court	Fairfax	22032	3	0	1	2	2	366	O[po
Santa-yana Drive	Fairfax	22031	3	3	2	3	3	365	O[po
Morning-ton Court	Fairfax	22032	5	3	6	6	5	285	O[po
Alba Place	Fairfax	22031	2	2	3	2	2	349	O[po
Clermont Landing Ct	Burke	22015	2	2	2	3	2	301	O[po
Anchor Court	Fairfax	22032	10	12	3	7	8	312	O[po
Prince William Dr.	Fairfax	22031	4	7	5	6	6	360	O[po
Chiches-ter Lane	Fairfax	22031	2	2	2	2	2	309	O[po
Stall-worth Court	Fairfax	22032	2	3	0	3	2	271	O[po
Swin-burne Court	Fairfax	22031	4	4	1	3	3	387	O[po
Shingle Oak Court	Burke	22015	0	2	0	1	2	318	O[po
Bear Oak Court	Burke	22015	0	0	0	2	2	317	O[po
Chase Common s Ct 208	Burke	22015	7	6	8	10	8	369	O[po
Surveyors Ct	Vienna	22180	6	6	7	7	6	338	O[po
Colling-ham Drive	Fairfax	22032	14	0	21	11	15	319	O[po
Lamarre Drive	Fairfax	22030	0	4	0	0	4	411	O[po

Acacia Lane	Fairfax	22032	3	4	4	5	4	395	O[po
Union Camp Dr	Fairfax St	22039	4	5	4	5	5	269	O[po
Union Camp Dr	Fairfax St	22039	5	4	4	4	4	269	O[po
Hayns-worth Pl	Fairfax	22031	4	8	7	6	6	331	O[po
Kelley Dr	Fairfax	22030	4	3	2	3	3	300	O[po
Headly Court	Fairfax	22032	3	3	0	3	3	280	O[po
Blake Lane	Fairfax	22031	6	6	6	6	6	336	O[po
Chapel Road	Clifton	22024	0	4	4	0	4	352	O[po
Carter-wood Dr.	Fairfax	22032	0	2	1	0	2	335	O[po
De-Quincey Dr.	Fairfax	22032	4	4	2	3	3	322	O[po
Nantuck-et Ct.	Fairfax	22030	6	10	6	5	7	280	O[po
Wheats-tone Dr	Fairfax	22032	2	5	4	3	3	298	O[po
Hamilton Drive	Fairfax	22031	1	1	2	2	1	297	O[po
Young's Branche Dr.	Fairfax Stati	22039	0	0	10	19	15	298	O[po
Beaum-ont Street	Fairfax	22030	1	1	2	2	1	308	O[po
Havenner Ct.	Fairfax Stati	22039	3	2	2	3	2	296	O[po
St. Marks Pl	Fairfax	22031	4	7	7	9	7	346	O[po
Red Spruce Rd.	Fairfax	22032	1	1	0	21	7	291	O[po
Pickett Rd	Fairfax	22032	0	0	0	0	0	363	O[po
Clif-ton Creek Dr	Clifton	22024	6	6	2	7	5	330	O[po
Clif-ton	Clifton	22024	6	6	2	7	5	330	O[po

Creek Dr									
Lamarre Dr	Fairfax	22030	9	9	10	12	10	408	O[po
Galswo-rth Ct	Fairfax	22032	4	3	3	3	3	357	O[po
Wheats-tone Drive	Fairfax	22032	0	26	6	20	17	307	O[po
Clara Way	Fairfax Stati	22039	0	7	7	0	7	329	O[po
Beech Ridge Drive	Fairfax	22030	0	0	0	0	0	358	O[po
Yates Ford Road	Clifton	22024	0	0	0	0	0	271	O[po
Main Street, Box 172	Clifton	22024	0	0	0	0	0	311	O[po
Colchest-er Road	Fairfax Stati	22039	0	0	0	0	0	392	O[po
Split Oak Lane	Burke	22015	0	0	0	0	0	302	O[po
Fair-fax Station Road	Fairfax Stati	22039	0	0	0	0	0	268	O[po
Burnside Landing Drive	Burke	22015	0	0	0	0	0	324	O[po
Barkley Drive	Fairfax	22031	1	1	2	1	1	297	O[po
Old Creek Drive	Fairfax	22032	2	1	2	4	2	364	O[po
Anchor Ct	Fairfax	22032	4	0	1	0	2	312	O[po
Stone-leigh Ct	Fairfax	22031	1	1	1	1	1	318	O[po
Wheats-tone Dr	Fairfax	22032	0	2	1	1	2	298	O[po
Youngs Branch Dr	Fairfax Stat	22039	0	1	1	2	1	289	O[po

Arrington Dr	Fairfax Stat	22039	0	0	0	0	0	299	O[po
Colling-ham Dr	Fairfax	22032	0	0	0	0	0	319	O[po
Haynes-worth Place	Fairfax	22031	0	0	0	0	0	331	O[po
Barford Court	Chan-tilly	22021	22	20	6	9	14	330	D
Barford Court	Chan-tilly	22021	0	0	0	0	0	333	D
Cub Run Road	Chan-tilly	22021	4	5	2	4	4	372	D
Point Pleasant Dr	Chan-tilly	22021	2	2	2	3	2	360	D
Springs-tone Drive	Clifton	22024	2	2	1	2	2	284	D
Marble Rock Court	Chan-tilly	22021	6	6	2	4	5	306	D
Pt. Pleasant Drive	Chan-tilly	22021	10	5	3	8	6	329	D
Melville Lane	Chan-tilly	22021	1	0	1	1	1	316	D
Louis Mill Dr	Chan-tilly	22021	2	2	2	3	2	427	D
Gold Post Court	Centr-eville	22020	2	3	4	5	3	351	D
Point Pleasant Pl	Chan-tilly	22021	6	10	4	5	6	326	D
Rockton Ct	Centr-eville	22020	7	6	9	7	7	260	D
Barford Court	Chan-tilly	22021	0	0	0	0	0	330	D
Pine Creek Court	Mc-Lean	22101	2	2	2	3	2	392	[gi
Oakmont Ct	Vienna	22180	3	3	2	0	3	314	Msg

Quaint Lane	Vienna	22180	3	5	5	6	5	256	Msg
Silentree Drive	Vienna	22180	3	3	3	3	3	277	Msg
Silentree Drive	Vienna	22180	3	4	2	3	3	276	Msg
Silentree Drive	Vienna	22180	2	0	2	2	2	278	Msg
Wolftrap Road	Vienna	22180	6	7	2	5	5	267	Msg
Wolftrap Rd	Vienna	22180	2	1	1	1	1	267	Msg
Long-fellow Street	Mc-Lean	22101	2	2	3	3	3	353	[gi
Long-fellow Court	Mc-Lean	22101	41	33	7	78	40	353	[gi
Long-fellow Ct	Mc-Lean	22101	0	0	0	0	0	353	[gi
Spinnaker Court	Reston	22091	19	25	8	8	15	427	[Zmg
Glade Drive	Reston	22091	5	4	3	0	4	492	[Zmg
Clarks Landing Dr.	Oakton	22124	5	3	3	3	3	424	[Zmg
Spinnaker Court	Reston	22091	4	3	2	3	3	427	[Zmg
Timber-line Ct	Oakton	22124	2	1	1	2	1	386	[Zmg
Birdfoot Lane	Reston	22091	6	3	3	3	4	429	[Zmg
Spinnaker	Reston	22091	2	5	3	3	3	427	[Zmg
Hunters Crest Way	Vienna	22124	32	24	1	41	25	415	[Zmg
Freetown Drive	Reston	22091	3	3	5	5	4	277	[Zmg
Freetown Drive	Reston	22091	0	0	0	0	0	287	[Zmg
Greenbrier Court	Reston	22090	8	6	3	5	6	425	Water

Green-brier Ct.	Reston	22090	3	5	3	4	4	428	Water
Shagbark Cir.	Reston	22090	8	12	8	15	11	457	Water
Ballan-trae Farm Dr.	Mc-Lean	22101	3	3	3	4	3	338	[sv
Madison Ct	Mc-Lean	22101	4	5	6	6	5	387	[sv
Shipman Lane	Mc-Lean	22101	4	3	3	4	3	405	[sv
Mint-wood Dr	Mc-Lean	22101	4	4	3	5	4	366	[sv
Leeland Dr	Falls Church	22043	6	4	3	4	4	303	[sv
Leeland Dr	Falls Church	22043	0	0	2	0	2	303	[sv
Mint-wood Dr	Mc-Lean	22101	26	21	0	0	24	376	[sv
Old Chester-brook Rd	Mc-Lean	22101	14	0	0	0	14	355	[sv
Park Road	Mc-Lean	22101	5	6	4	6	5	338	[sv
Shady Lane	Falls Church	22042	3	2	2	2	2	314	[sv
Langley Lane	Mc-Lean	22101	3	2	1	0	2	270	[sv
Hitt Ave.	Mc-Lean	22101	3	3	2	0	3	373	[sv
Forest Drive	Falls Church	22046	2	2	1	1	1	289	[sv
Tennyson Drive	Mc-Lean	22101	5	3	1	2	3	302	[sv
Jenkins Lane	Falls Church	22043	2	2	5	0	3	405	[sv
Douglass Drive	Mc-Lean	22101	4	3	3	2	3	388	[sv
Baron Road	Mc-Lean	22101	3	2	2	3	3	357	[sv
Chester-field Place	Mc-Lean	22101	2	3	1	2	2	389	[sv

Lumsden Street	Mc-Lean	22101	5	5	4	3	4	390	[sv
Caron Lane	Falls Church	22043	3	2	1	2	2	200	[sv
Venice Court	Falls Church	22043	2	1	3	3	2	218	[sv
Mayflo-wer Drive	Mc-Lean	22101	2	2	1	2	2	321	[sv
Mayflo-wer Drive	Mc-Lean	22101	0	0	0	0	0	325	[sv
Holyrod Drive	Mc-Lean	22101	4	4	4	6	4	421	[sv
Virginia Avenue	Falls Church	22043	1	2	1	2	1	253	[sv
Massa-chusetts Ave	Mc-Lean	22101	2	2	3	3	3	280	[sv
Meridan Street	Falls Church	22046	2	2	1	2	2	302	[sv
Cedar-wood Lane	Falls Church	22042	0	1	2	2	2	233	[sv
Linden Lane	Falls Church	22042	2	1	1	2	2	298	[sv
Kellogg Drive	Mc-Lean	22101	6	3	1	3	3	397	[sv
Kellogg Drive	Mc-Lean	22101	0	3	0	0	3	371	[sv
Broyhill Street	Mc-Lean	22101	2	1	2	3	2	395	[sv
Massa-chusetts Avenue	Mc-Lean	22101	0	0	0	4	4	244	[sv
Brook-haven Drive	Mc-Lean	22101	5	7	3	3	4	395	[sv
Susque-hannock Drive	Mc-Lean	22101	5	10	4	4	6	330	[sv
East Avenue	Mc-Lean	22101	0	4	2	3	3	360	[sv
Buchanan Street	Mc-Lean	22101	10	0	7	8	6	367	[sv

Broad Branch Court	Mc-Lean	22101	3	3	6	5	4	398	[sv
Old Chester-brook Rd	Mc-Lean	22101	3	0	2	2	2	382	[sv
Tompkins Drive	Mc-Lean	22101	2	2	1	2	2	389	[sv
Powhatan Street	Arlingt on	22207	1	2	2	2	2	264	[sv
Fern Oak Court	Mc-Lean	22101	5	4	3	4	4	357	[sv
Elizabeth Drive	Mc-Lean	22101	3	3	3	4	3	367	[sv
Wooda-cre Drive	Mc-Lean	22101	2	3	2	2	2	333	[sv
West-moreland Street	Falls Church	22046	3	4	3	4	4	290	[sv
Kirklyn Street	Falls Church	22043	3	3	3	5	3	329	[sv
Forest Lane	Mc-Lean	22101	1	0	3	4	2	301	[sv
Wood-land Terrace	Mc-Lean	22101	2	0	2	2	2	314	[sv
McLean Court	Mc-Lean	22101	4	7	4	3	4	374	[sv
N. West-moreland St.	Arlingt on	22213	2	4	3	4	3	383	[sv
Great Falls Street	Mc-Lean	22101	2	1	3	2	2	328	[sv
Ingleside Avenue	Mc-Lean	22101	0	0	4	6	5	372	[sv
Buena Vista Avenue	Mc-Lean	22101	2	0	1	2	2	321	[sv
Bent Twig Road	Mc-Lean	22101	5	0	3	5	4	312	[sv
Kent	Falls	22046	0	1	1	1	1	281	[sv

Street	Church								
Orland Street	Falls Church	22043	3	4	2	2	3	298	[sv
Diplomat Court	Falls Church	22043	5	5	5	5	5	374	[sv
Mac-Arthur Drive	Mc-Lean	22101	2	2	2	3	2	259	[sv
Great Falls Street	Mc-Lean	22101	2	2	2	4	2	334	[sv
South-ridge Drive	Mc-Lean	22101	2	2	2	2	2	328	[sv
Johns Road	Falls Church	22043	3	0	1	3	2	225	[sv
Chelsea Road	Mc-Lean	22101	4	5	1	4	3	307	[sv
Morrill Court	Mc-Lean	22101	2	0	1	2	2	370	[sv
Leeland Drive	Falls Church	22043	3	3	0	4	3	303	[sv
Kirby Road	Mc-Lean	22101	21	0	11	12	15	344	[sv
Kenbar Court	Mc-Lean	22101	3	4	3	3	3	253	[sv
McLean Court	Mc-Lean	22101	4	4	3	3	3	374	[sv
Barbee Street	Mc-Lean	22101	3	3	4	4	3	340	[sv
Hardy Court	Mc-Lean	22101	3	2	2	3	3	399	[sv
McLean Mews Court	Mc-Lean	22101	5	2	4	4	4	337	[sv
McFall Street	Mc-Lean	22101	1	2	1	3	2	369	[sv
McLean Drive	Mc-Lean	22101	3	0	2	2	2	369	[sv
Ivy Hill Drive	Mc-Lean	22101	2	2	1	3	2	390	[sv
Dead Run Drive	Mc-Lean	22101	5	5	5	6	5	416	[sv

Young-blood Street	Mc-Lean	22101	0	0	5	2	4	352	[sv
Ridge Road	Mc-Lean	20101	3	3	2	3	3	353	[sv
Ridge Road	Mc-Lean	20101	0	0	2	0	2	353	[sv
Chestnut Street	Falls Church	22043	3	2	2	3	2	225	[sv
Lanham Road	Falls Church	20043	1	1	2	1	1	233	[sv
Deidre Terrace	Mc-Lean	22101	4	0	0	3	4	293	[sv
Allan Avenue	Falls Church	22046	5	4	3	4	4	209	[sv
E. Columbia Street	Falls Church	22046	0	0	0	2	2	288	[sv
Natahoa Court	Falls Church	22043	2	2	2	3	2	265	[sv
Copely Lane	Mc-Lean	22101	0	0	0	0	0	348	[sv
Ridge Drive	Mc-Lean	22101	3	4	0	2	3	352	[sv
Somerset Drive	Mc-Lean	22101	5	5	3	3	4	362	[sv
Stoneham Court	Mc-Lean	22101	6	0	0	11	8	364	[sv
Dead Run Drive	Mc-Lean	22101	1	1	0	1	1	397	[sv
Fairlawn Drive	Mc-Lean	22101	3	2	0	3	3	368	[sv
Wood-gate Lane	Mc-Lean	22101	5	4	6	7	5	359	[sv
Falls Place Court	Falls Church	22043	8	0	0	0	8	234	[sv
Strine Dr	Mc-Lean	22101	2	3	3	3	3	340	[sv
B East Broad St.	Falls Church	22046	3	5	3	4	4	236	[sv
Susque-hannock	Mc-Lean	22101	6	5	4	6	5	330	[sv

Dr.									
Fairview Ave	Mc-Lean	22101	5	3	9	8	6	335	[sv
Valley Wood Rd	Mc-Lean	22101	1	2	0	3	2	283	[sv
Briar Ridge Road	Mc-Lean	22101	0	0	0	0	0	341	[sv
Harvey Road	Mc-Lean	22101	0	0	0	0	0	336	[sv
Ballan-trae Lane	Mc-Lean	22101	1	1	1	2	1	395	[sv
Buckelew Drive	Falls Church	22046	3	2	2	2	2	207	[sv
Fairview Ave.	Mc-Lean	22101	0	0	0	0	0	335	[sv
Allan Avenue	Falls Church	22046	0	0	0	0	0	209	[sv
Deidre Terrace	Mc-Lean	22101	0	0	0	0	0	293	[sv
Cranoke Street	Centr-eville	22020	5	2	2	3	3	449	Ss
Clubside Lane	Centr-eville	22020	14	11	5	7	9	488	Ss
Honsena Drive	Centr-eville	22020	0	4	0	0	4	356	Ss
Euphrates Court	Centr-eville	22020	0	0	0	0	0	479	Ss
Overland Court	Centr-eville	22020	2	0	2	4	3	480	Ss
Green Park Way	Centr-eville	22020	2	2	3	3	2	402	Ss
Hunting Path Place	Centr-eville	22020	0	9	5	8	7	504	Ss
Cristo Court	Centerv ille	22020	1	0	1	1	1	503	Ss
Cristo Court	Centerv ille	22020	1	0	1	1	1	503	Ss
Burford Drive	Mc-Lean	22102	6	3	4	6	5	388	[Zmg
Old Dominion	Mc-Lean	22102	5	4	3	0	4	357	[Zmg

Drive									
Potomac Falls Road	Mc-Lean	22102	1	1	2	2	2	319	[Zmg
Falstaff Road	Mc-Lean	22102	5	7	3	4	4	368	[Zmg
Elsinore Ave.	Mc-Lean	22102	5	5	2	3	3	394	[Zmg
Swinks Mill Road	Mc-Lean	22102	3	0	3	4	3	410	[Zmg
Spring Chapel Ct	Hern-don	22071	3	3	3	0	3	364	S
Briar-grove Court	Hern-don	22071	7	6	3	9	6	278	S
Soft Breeze Ct	Hern-don	22071	2	2	0	0	2	394	S
Middle Ridge Drive	Fairfax	22033	1	1	1	2	1	316	S
Flag Court	Chan-tilly	22021	2	2	4	2	2	329	S
Ruby Lace Court	Hern-don	22071	7	5	15	7	8	363	S
Yukon Road	Hern-don	22071	5	3	3	4	4	471	S
Rounding Run Circle	Hern-don	22071	3	3	3	3	3	274	S
Carlsbad Court	Hern-don	22071	7	7	5	7	6	316	S
Braxton Road	Chan-tilly	22021	6	5	5	4	5	367	S
Braxton Road	Chan-tilly	22021	4	0	0	4	4	367	S
Muirkirk Lane	Hern-don	22071	2	2	1	0	2	392	S
Bryn-wood Place	Hern-don	22071	7	8	6	7	7	315	S
Magna	Hern-	22071	6	2	2	2	3	279	S

Carta Road	don								
Mansway Drive	Hern-don	22071	3	3	2	0	3	498	S
Apple-grove Lane	Hern-don	22071	3	3	2	0	3	354	S
Fern Hollow Place	Hern-don	22071	3	5	1	2	3	386	S
Flat Meadow Lane	Hern-don	22071	1	1	1	1	1	331	S
Laneview Court	Hern-don	22071	3	3	2	2	2	368	S
Oakham-pton Place	Hern-don	22071	7	1	4	5	4	300	S
Moss Ranch Lane	Fairfax	22033	1	1	1	2	1	298	S
Pleasant Glen Court	Hern-don	22071	4	4	3	0	4	371	S
Farthing-gale Drive	Hern-don	22071	4	6	4	0	5	447	S
Ruby Lace Court	Hern-don	22070	3	1	2	0	2	364	S
Birch Bark Court	Fairfax	22033	4	3	1	4	3	402	S
Birch Bark Court	Fairfax	22033	0	0	0	0	0	402	S
Treaty Oak Court	Fairfax	22033	4	3	4	3	4	400	S
Brook-field Dr	Chan-tilly	22021	0	2	1	2	2	374	S
New Parkland	Hern-don	22071	0	3	2	2	2	374	S

Drive									
Meadow Hill Lane	Fairfax	22033	1	1	1	1	1	267	S
Meadow Hill Lane	Fairfax	22033	0	3	0	0	3	269	S
Mt. Echo Lane	Fairfax	22033	1	2	1	2	2	318	S
Peach-wood Court	Fairfax	22033	2	3	1	2	2	399	S
Lazy Glen Ct.	Hern-don	22071	2	2	2	2	2	350	S
Cotton Top Court	Fairfax	22033	0	1	2	2	2	402	S
Brook-field Drive	Chan-tilly	22021	3	1	2	3	2	374	S
Cotton Top Court	Fairfax	22033	0	3	2	3	2	402	S
Union Village Cir	Clifton	22024	3	3	1	3	3	253	S
Memory Lane	Fairfax	22033	1	1	1	1	1	295	S
Winter Harbor Court	Chan-tilly	22021	0	1	0	0	1	468	S
Pleasant Glen Court	Hern-don	22071	0	4	2	3	3	370	S
Ashbur-ton Avenue	Hern-don	22070	0	1	1	0	1	298	S
Moss Ranch Lane	Fairfax	22033	0	1	1	2	1	298	S
Springs-tone Drive	Clifton	22024	0	2	2	2	2	283	S
Nestle-wood	Hern-don	22071	1	3	2	2	2	290	S

Drive									
Wrexham Road	Hern-don	22710	0	0	2	2	2	333	S
Pinecrest Road	Hern-don	22071	1	1	1	2	1	271	S
Apple-grove Lane	Hern-don	22071	1	1	1	1	1	320	S
Custom House Court	Fairfax	22033	1	0	1	1	1	338	S
Denmark Drive	Hern-don	22071	4	4	3	4	3	284	S
Cross Creek Lane	Hern-don	22071	1	5	2	2	3	260	S
Plum Dale Drive	Fairfax	22033	1	1	2	3	2	399	S
Point Pleasant Dr	Fairfax	22033	0	1	1	1	1	303	S
Poplar Tree Road	Fairfax	22033	0	0	0	0	0	272	S
Union Village Dr	Clifton	22024	2	1	1	1	1	252	S
Copper Creek Ct	Hern-don	22071	5	6	6	5	5	416	S
John Milton Dr.	Hern-don	22071	2	2	3	4	3	283	S
Running Pump Ct.	Hern-don	22071	0	4	4	5	4	370	S
White Barne Lane	Hern-don	22071	2	1	7	6	4	392	S
Briar-grove CT	Hern-don	22071	5	3	1	3	3	278	S
Oakham-pton Place	Hern-don	22071	2	1	1	3	2	300	S

White Barn Lane	Hern-don	22071	0	0	0	0	0	392	S
George-town Pike	Mc-Lean	22102	1	1	3	1	2	468	[sv
George-town Pike	Mc-Lean	22102	3	2	1	4	2	468	[sv
Tebbs Lane	Mc-Lean	22102	0	0	0	0	0	431	[Zmg
Tebbs Lane	Mc-Lean	22102	0	0	0	0	0	430	[Zmg
Colvin Forest Drive	Vienna	22180	2	1	0	0	1	477	[Zmg
Millwood Lane	Great Falls	22066	3	3	4	5	4	421	[Zmg
Fringer-tree Road	Great Falls	22066	0	0	0	0	0	408	[Zmg
Cutter-mill Court	Hern-don	22070	0	0	0	0	0	329	S
Artic Quill Road	Hern-don	22070	5	6	7	0	6	334	S
Oak Trail Court	Hern-don	22070	7	5	8	0	6	348	S
Powell's Tavern Pl.	Hern-don	22070	6	3	4	5	4	436	S
Fantasia Circle	Hern-don	22070	5	2	3	3	3	357	S
Fantasia Circle	Hern-don	22070	3	4	1	2	2	357	S
Grace Street	Hern-don	22070	2	1	1	1	1	293	S
Summer-field Drive	Hern-don	22070	0	6	3	5	4	336	S
Fantasia Drive	Hern-don	22070	4	5	3	3	4	385	S
Youngs Point Place	Hern-don	22070	8	8	2	2	5	421	S

Bayshire Lane	Hern-don	22070	1	0	1	2	2	328	S
Wood-shire Lane	Hern-don	22070	6	4	2	3	4	331	D
Brussels Court	Reston	22091	2	1	1	1	1	289	D
Caven-dish Street	Hern-don	22070	4	1	1	2	2	342	D
Brussels Court	Reston	22091	4	3	1	1	2	278	D
Wood-shire Lane	Hern-don	22070	4	5	2	4	4	331	D
Purple Sage Court	Hern-don	22070	1	5	1	1	2	336	D
Yellow Tavern Court	Hern-don	22070	3	3	2	2	2	403	Ss
Butter Churn Drive	Hern-don	22070	2	1	2	2	2	421	Ss
Rock Chapel Court	Hern-don	22070	5	6	3	5	5	413	Ss
Butter Churn Dr	Hern-don	22070	2	0	0	2	2	421	Ss
Jeffery Road	Great Falls	22066	0	0	0	0	0	354	[Zmg
Fox Run Ct	Vienna	22180	3	2	2	2	2	392	[Zms
Spring-vale Rd	Great Falls	22066	3	2	1	4	2	374	[Zms
Willow Dr	Vienna	22180	2	2	1	0	2	328	[Zms
Shouse Dr	Vienna	22180	7	4	5	5	5	427	[Zms
Bellmont Dr	Fairfax	22030	10	7	4	5	6	406	[Zms
Park Street SE	Vienna	22180	5	3	2	4	3	358	[Zms

Quail Ridge Ct	Reston	22094	12	11	5	1	7	438	[Zms
Battle Street SW	Vienna	22180	2	0	1	1	1	378	[Zms
West-wood Hills Dr	Hern-don	22071	3	2	1	2	2	388	[Zms
Mt. Sunapec Road	Vienna	22180	3	7	5	0	5	435	[Zms
Glencoe Drive	Vienna	22180	3	3	2	2	2	333	[Zms
Golden Eagle Drive	Reston	22094	6	6	3	4	4	362	[Zms
Waters Edge Lane	Reston	22090	4	1	1	2	2	402	[Zms
Railroad Court	Fairfax	22030	2	1	1	2	1	361	[Zms
Brook Rd	Mc-Lean	22102	6	4	2	3	4	425	[Zms
Brook Rd	Mc-Lean	22102	3	3	0	0	3	425	[Zms
Belleview Rd	Mc-Lean	22102	4	0	0	0	4	401	[Zms
Berryland Court	Oakton	22124	3	2	0	0	3	457	[Zms
Carnegie Dr	Vienna	22180	15	10	0	0	12	339	[Zms
Challe-don Road	Great Falls	22066	10	9	4	4	6	380	[Zms
Challe-don Road	Great Falls	22066	0	3	0	0	3	380	[Zms
Rockport Rd	Vienna	22180	3	1	3	1	2	342	[Zms
Briggs Road	Fairfax	22030	7	6	3	6	6	332	[Zms
Telfer Court	Vienna	22180	5	4	3	2	3	367	[Zms
Handle-bar Rd	Reston	22091	3	2	4	4	3	384	[Zms

Holyview Dr	Great Falls	22066	6	3	1	0	3	428	[Zms
Barton Hill Road	Reston	22091	7	7	3	3	5	474	[Zms
Barton Hill Road	Reston	22091	0	0	3	0	3	474	[Zms
Cream-cup Lane	Great Falls	22066	6	4	2	5	4	448	[Zms
Spring Side Way	Mc-Lean	22101	6	3	5	6	5	314	[Zms
Rich Meadow Drive	Great Falls	22066	3	4	5	5	4	360	[Zms
Foxhound Rd	Mc-Lean	22102	5	6	5	8	6	426	[Zms
George-town Pike	Mc-Lean	22102	2	1	1	2	1	379	[Zms
Titania Lane	Mc-Lean	22102	3	2	0	4	3	409	[Zms
Old Cedar Road	Mc-Lean	22102	6	4	3	3	4	396	[Zms
Rocky Run Road	Mc-Lean	22102	4	5	4	8	5	453	[Zms
Constell-ation Dr.	Great Falls	22066	15	9	6	8	10	519	[Zms
Constell-ation Dr.	Great Falls	22066	0	2	0	0	2	519	[Zms
Chain Bridge Road	Vienna	22180	1	1	2	2	2	271	[Zms
Vale Road	Oakton	22124	36	23	1	3	16	424	[Zms
Birnam Wood Drive	Mc-Lean	22102	4	4	4	6	4	411	[Zms
Orchid Circle	Great Falls	22066	10	9	5	7	8	438	[Zms
Turtle Pond Dr.	Reston	22091	4	2	0	4	3	383	[Zms
Turtle Pond Dr.	Reston	22091	0	0	0	0	0	383	[Zms
George-	Great	22066	4	2	1	2	2	474	[Zms

town Pike	Falls								
George-town Pike	Great Falls	22066	0	0	0	0	0	474	[Zms
Carrhill Road	Vienna	22180	5	4	4	5	4	353	[Zms
Winter-green Court	Reston	22091	9	8	4	6	7	433	[Zms
Chadds Ford Drive	Reston	22091	4	3	2	2	3	355	[Zms
Golden Eagle Drive	Reston	22094	13	11	6	11	10	362	[Zms
Cross School Road	Reston	22091	14	12	4	0	10	430	[Zms
Stirrup Road	Reston	22091	8	5	5	5	6	291	[Zms
Quail Ridge Drive	Reston	22094	5	3	3	4	4	376	[Zms
Brook-trail Ct.	Vienna	22180	5	7	10	7	7	346	[Zms
Pony Lane	Reston	22091	7	5	5	5	5	366	[Zms
Pony Lane	Reston	22091	5	6	5	3	5	366	[Zms
Silentree Drive	Vienna	22180	12	9	5	7	8	271	[Zms
Silentree Drive	Vienna	22180	0	0	0	0	0	272	[Zms
Full Cry Court	Oakton	22124	3	2	3	0	2	482	[Zms
Full Cry Court	Oakton	22124	0	3	0	0	3	483	[Zms
Homer Terrace	Reston	22091	5	4	3	5	4	370	[Zms
Spinet Court	Vienna	22180	12	9	5	7	8	458	[Zms
Decade Street	Reston	22091	4	3	4	0	3	328	[Zms
Old	Reston	22091	4	3	2	0	3	351	[Zms

Bayberry Lane									
Acton Drive	Reston	22091	10	10	7	0	9	403	[Zms
Deer Forest Road	Reston	22094	7	7	3	6	6	375	[Zms
Rich Meadow Drive	Great Falls	22066	2	2	1	2	2	360	[Zms
Quail Ridge Court	Reston	22094	9	8	5	10	8	428	[Zms
Hunter Mill Road	Vienna	22180	3	1	1	2	2	325	[Zms
Burch Pond Lane	Fairfax	22033	2	1	1	0	1	346	[Zms
Triple Crown Rd.	Reston	22091	3	2	2	2	2	333	[Zms
Turtle Pond Drive	Reston	22091	2	2	2	0	2	384	[Zms
Walker Road	Great Falls	22066	2	3	4	4	3	476	[Zms
Walker Road	Great Falls	22066	4	0	0	4	4	476	[Zms
Pebble Beach Drive	Vienna	22180	1	1	1	0	1	349	[Zms
Auburn Grove Court	Reston	22094	6	0	0	0	6	372	[Zms
Gould-man Lane	Great Falls	22066	5	1	4	4	3	388	[Zms
Hunt-master Lane	Mc-Lean	22102	3	3	2	0	3	324	[Zms
Foxmill Road	Oakton	22124	14	17	4	8	11	394	[Zms
Vistas	Mc-	22101	3	2	2	3	2	323	[Zms

Lane	Lean								
Summit Drive	Fairfax	22030	4	5	7	7	6	338	[Zms
Litwalton Court	Vienna	22180	3	3	4	4	3	355	[Zms
Vistas Lane	Mc-Lean	22101	2	1	2	3	2	323	[Zms
Quail Ridge Court	Reston	22094	3	4	2	0	3	430	[Zms
Yates Court	Mc-Lean	22101	5	7	5	6	6	286	[Zms
Old Dominion Drive	Mc-Lean	22102	2	2	1	2	2	423	[Zms
Old Dominion Drive	Mc-Lean	22102	0	0	0	0	0	423	[Zms
Tanbark Drive	Reston	22091	4	2	2	2	3	424	[Zms
William Terry Drive	Vienna	22180	22	22	11	12	17	421	[Zms
Amber-jack Court	Reston	22091	15	14	4	3	9	377	[Zms
Ozkan Street	Mc-Lean	22101	5	6	4	5	5	284	[Zms
Jean Place, N.E.	Vienna	22180	4	4	5	4	4	316	[Zms
Trophy Lane	Reston	22091	4	5	4	2	4	305	[Zms
Ivy Bush Court	Reston	22091	6	2	1	3	3	363	[Zms
Clover Meadow Drive	Vienna	22180	3	3	4	3	3	440	[Zms
Brevity Drive	Great Falls	22066	4	3	3	3	3	415	[Zms
Montague Drive	Vienna	22180	5	3	2	4	4	495	[Zms
Montague	Vienna	22180	4	4	4	4	4	495	[Zms

Drive									
Fox Mill Road	Hern-don	22071	2	2	2	2	2	294	[Zms
Sawdust Road	Vienna	22180	7	7	6	6	6	415	[Zms
Golf Course Drive	Reston	22091	3	4	2	3	3	363	[Zms
Tartan Court	Vienna	22180	2	2	3	3	2	351	[Zms
Aubrey Place Court	Vienna	22180	3	3	1	2	2	443	[Zms
Aubrey Place Court	Vienna	22180	0	3	0	0	3	443	[Zms
Hill Road	Vienna	22180	6	5	3	7	5	365	[Zms
Salt Kettle Way	Reston	22091	5	3	2	3	3	407	[Zms
Cobble-stone Lane	Reston	22091	8	11	7	6	8	384	[Zms
Lake Ridge Drive	Oakton	22124	3	3	4	4	3	463	[Zms
Old Dominion Dr	Mc-Lean	22102	10	10	6	8	8	384	[Zms
North-woods Trail	Mc-Lean	22102	2	2	2	0	2	425	[Zms
Helmont Drive	Oakton	22124	4	5	3	5	4	380	[Zms
Brambe-lbush Court	Reston	22091	0	5	3	5	5	360	[Zms
Shouse Drive	Vienna	22180	2	2	2	2	2	407	[Zms
Bree Hill Road	Oakton	22124	0	2	3	2	2	406	[Zms
Delancey Drive	Vienna	22180	2	5	1	1	2	379	[Zms

Beekay Court	Vienna	22180	4	5	4	4	4	352	[Zms
History Drive	Oakton	22124	2	2	2	4	2	378	[Zms
Riva Ridge Drive	Great Falls	22066	0	2	2	4	2	554	[Zms
Portland Place	Mc-Lean	22102	4	5	4	5	5	338	[Zms
Riva Ridge Drive	Great Falls	22066	0	1	3	5	3	554	[Zms
Loch Lomond Drive	Vienna	22180	0	4	3	1	3	369	[Zms
Plantation Parkway	Fairfax	22030	7	7	3	5	5	375	[Zms
Spruce Avenue	Fairfax	22030	4	3	4	4	4	382	[Zms
Notting-ham Drive	Falls Church	22043	1	1	1	1	1	284	[Zms
Clover-meadow Drive	Vienna	22180	8	11	7	4	7	415	[Zms
Davis-wood Drive	Mc-Lean	22102	1	2	1	2	2	376	[Zms
Larkmea-de Drive	Vienna	22180	1	1	2	1	1	371	[Zms
Farrier Lane	Reston	22091	5	5	4	5	5	288	[Zms
Vernon Drive	Great Falls	22066	8	9	4	6	7	555	[Zms
Brians Hill Lane	Oakton	22124	0	3	4	6	4	380	[Zms
Senseney Lane	Falls Church	22043	1	1	1	2	1	301	[Zms
Rivera Drive	Vienna	22180	1	1	1	2	1	392	[Zms
Gunnell Farms Drive	Vienna	22180	0	3	3	3	3	415	[Zms

Wilhelm Drive	Great Falls	22066	0	6	4	0	5	493	[Zms
Ranger Road	Fairfax	22030	1	1	1	2	1	390	[Zms
Berryland Drive	Oakton	22124	5	39	11	17	18	454	[Zms
Sunny Side Lane	Mc-Lean	22102	10	9	5	7	8	457	[Zms
Fox Run Court	Vienna	22180	6	5	2	5	4	392	[Zms
Del Rio Drive	Fairfax	22030	2	2	2	2	2	364	[Zms
Birnam Wood Drive	Mc-Lean	22102	8	9	6	8	8	386	[Zms
William Terry Drive	Vienna	22180	9	10	5	6	7	421	[Zms
William Terry Drive	Vienna	22180	10	10	6	8	8	421	[Zms
Amber-jack Court	Reston	22091	6	10	10	3	7	377	[Zms
Amber-jack Court	Reston	22091	9	11	6	4	8	377	[Zms
Paddock Lane	Reston	22091	7	5	7	8	7	295	[Zms
St. Roman Drive	Vienna	22180	3	5	3	4	4	366	[Zms
George-town Pike	Great Falls	22066	1	2	1	2	2	474	[Zms
Wild Cherry Place	Reston	22091	0	0	0	0	0	296	[Zms
Harriman Street	Great Falls	22066	8	7	5	7	7	488	[Zms
Riders Lane	Reston	22091	4	4	3	0	4	298	[Zms
Mary-mead	Fairfax	22030	3	4	2	3	3	384	[Zms

Drive									
Lewins-ville Road	Mc-Lean	22102	5	0	2	4	4	375	[Zms
Hatmark Court	Vienna	22180	3	3	3	3	3	355	[Zms
Dogwood Street, SW	Vienna	22180	2	2	3	2	2	370	[Zms
Evans Mill Road	Mc-Lean	22101	0	0	3	0	3	307	[Zms
Cedar Lane	Vienna	22180	0	0	2	0	2	305	[Zms
Walker Road	Great Falls	22066	8	6	9	7	8	525	[Zms
Snow-berry Court	Vienna	22180	3	3	2	2	2	318	[Zms
Fowlers Lane	Reston	22091	5	7	5	7	6	299	[Zms
Concert Court	Vienna	22180	2	0	3	3	3	397	[Zms
Flemish Mill Court	Oakton	22124	4	3	3	3	3	444	[Zms
Hunter Mill Road	Vienna	22180	7	7	9	10	8	392	[Zms
Westwod Hills Drive	Hern-don	22071	3	0	2	3	2	409	[Zms
Marcliff Court	Vienna	22180	2	2	2	3	2	375	[Zms
Titania Lane	Mc-Lean	22102	2	0	3	4	3	413	[Zms
Leigh Mill Road	Great Falls	22066	2	0	3	5	3	446	[Zms
Arnon Meadow Road	Great Falls	22066	4	0	3	3	3	440	[Zms
Old	Mc-	22102	4	3	2	2	3	324	[Zms

Dominion Drive	Lean								
Brook Road	Mc-Lean	22102	2	0	2	2	2	344	[Zms
Indian Ridge Road	Reston	22091	2	1	1	1	1	360	[Zms
Mediter-ranean Court	Reston	20090	3	3	2	4	3	369	[Zms
Hunter Station Road	Vienna	22180	25	3	27	24	19	449	[Zms
Waythorn Place	Fairfax	22033	1	1	3	2	2	285	[Zms
George-town Pike	Great Falls	22066	6	7	2	5	5	452	[Zms
Full Cry Court	Oakton	22124	4	0	3	5	4	482	[Zms
Samaga Drive	Oakton	22124	16	22	11	12	15	470	[Zms
O'Faly Road	Fairfax	22030	4	4	4	5	4	434	[Zms
Red Leaf Court	Reston	22091	7	7	7	10	8	332	[Zms
Waples Mill Road	Oakton	22124	6	7	6	9	7	406	[Zms
Blythe Dale Court	Vienna	22180	4	3	3	5	3	421	[Zms
Deer Forest Road	Reston	22094	6	7	4	5	6	445	[Zms
Adhoc Road	Great Falls	22066	5	0	4	4	4	457	[Zms
Portia Place	Mc-Lean	22102	2	3	3	3	3	404	[Zms
Edgepark Road	Vienna	22180	20	0	10	11	14	529	[Zms
Sour-wood Lane	Reston	22091	4	2	7	5	5	306	[Zms

Huntover Court	Mc-Lean	22102	8	1	9	8	6	371	[Zms
Mary Ellen Court	Mc-Lean	22101	0	0	0	0	0	328	[Zms
Benning-ton Woods Rd	Reston	22094	2	0	3	3	3	337	[Zms
Octagon Court	Fairfax	22030	5	0	3	4	4	393	[Zms
Matthew Mills Road	Mc-Lean	22101	2	2	2	2	2	337	[Zms
Bury-wood Lane	Reston	22090	5	4	4	5	5	416	[Zms
Sabastian Drive	Fairfax	22030	4	3	3	5	4	391	[Zms
Higdon Drive	Vienna	22180	5	6	3	4	4	322	[Zms
Batten Hollow Road	Vienna	22180	5	0	8	17	10	355	[Zms
Hounds Lane	Reston	22091	3	4	2	3	3	290	[Zms
Villanova Drive	Vienna	22180	4	0	3	4	3	327	[Zms
Fairway Drive, NE	Vienna	22180	2	2	2	3	2	387	[Zms
Hilling-ton Court	Vienna	22180	5	4	2	5	4	367	[Zms
Asoleado Lane	Vienna	22180	3	0	3	3	3	445	[Zms
Holly Leaf Drive	Mc-Lean	22102	0	2	0	3	2	388	[Zms
Blue Coat Drive	Fairfax	22030	2	3	4	3	3	395	[Zms
Blue Coat Drive	Fairfax	22030	4	2	3	2	3	395	[Zms
Clover-	Vienna	22180	13	15	10	13	13	415	[Zms

meadow Drive									
Whisper-wood Glen Ln	Reston	22091	1	1	5	2	2	421	[Zms
Joy Lane	Vienna	22180	6	6	0	5	5	422	[Zms
Van Dusen Court	Great Falls	22066	6	1	2	7	4	483	[Zms
Paddock Lane	Reston	22091	4	5	4	3	4	277	[Zms
Old Court-house Road	Vienna	22180	13	4	2	13	8	422	[Zms
Fosbak Drive	Vienna	22180	4	4	5	5	5	422	[Zms
Sandra Lane	Fairfax	22030	2	0	0	2	2	325	[Zms
Pommel Court	Oakton	22124	0	0	0	0	0	369	[Zms
Foxstone Drive	Vienna	22180	0	3	0	3	2	318	[Zms
Purple Beech Drive	Reston	22091	3	2	0	3	3	382	[Zms
Mill Street, SE	Vienna	22180	0	2	2	2	2	309	[Zms
Glenoak Court	Vienna	22180	9	7	8	12	9	323	[Zms
Trenholm Drive	Oakton	22124	11	11	0	18	13	464	[Zms
Benning-ton Woods Rd	Reston	22094	5	0	0	6	5	337	[Zms
Ivystone Ct. - 100	Reston	22091	1	3	4	0	3	367	[Zms
Aubrey Place Court	Vienna	22180	2	3	3	5	3	443	[Zms
Sawdust Road	Vienna	22180	14	12	5	4	9	405	[Zms

Burgee Court	Reston	22091	2	2	3	2	2	416	[Zms
Tazewell Road, NW	Vienna	22180	5	8	6	4	6	361	[Zms
Fox Mill Road	Oakton	22124	1	1	2	2	2	389	[Zms
Golf Course Drive	Reston	22091	0	1	1	0	1	357	[Zms
Sawdust Road	Vienna	22180	3	4	5	7	5	406	[Zms
Litwalton Court	Vienna	22180	2	2	3	3	2	355	[Zms
North-woods Trail	Mc-Lean	22102	3	3	3	4	3	427	[Zms
Hunters Valley Rd.	Vienna	22180	19	20	13	7	15	409	[Zms
Master-works drive	Vienna	22180	0	1	0	1	1	412	[Zms
Master-works drive	Vienna	22180	0	3	0	2	2	412	[Zms
Holly Leaf Dr	Mc-Lean	22102	3	4	2	3	3	382	[Zms
Blythe Dale Ct	Vienna	22180	2	2	1	1	2	421	[Zms
Turf Lane	Reston	22091	3	5	5	3	4	307	[Zms
Holly Leaf Drive	Mc-Lean	22102	4	4	4	7	5	396	[Zms
Quail Ridge Drive	Reston	22094	0	2	3	4	3	378	[Zms
Darrow Court	Vienna	22180	2	4	3	3	3	378	[Zms
Samaga Drive	Oakton	22124	0	0	0	0	0	422	[Zms
Hunter Station	Vienna	22180	1	1	3	2	2	449	[Zms

Rd.									
Rock Manor Ct.	Hern-don	22071	7	8	5	10	8	330	[Zms
Oxford-shire RD.	Great Falls	22066	0	0	0	0	0	523	[Zms
Birnam Wood Dr.	Mc-Lean	22102	5	5	0	5	5	411	[Zms
Golden Eagle Dr	Reston	22094	6	5	6	7	6	362	[Zms
Clover-meadow Dr	Vienna	22180	6	6	0	4	5	415	[Zms
Clover-meadow Dr	Vienna	22180	0	6	0	5	5	415	[Zms
Purple Beech Dr.	Reston	22091	3	6	5	6	5	352	[Zms
Purple Beech Drive	Reston	22091	5	19	6	17	12	352	[Zms
North-woods Terrace	Mc-Lean	22102	3	0	0	2	3	417	[Zms
North-woods Terrace	Mc-Lean	22102	0	0	2	0	2	417	[Zms
George-town Pike	Mc-Lean	22102	2	3	2	2	2	373	[Zms
Foxhound Road	Mc-Lean	22102	0	0	5	3	4	426	[Zms
Berryland Dr	Oakton	22124	6	3	6	9	6	455	[Zms
Old Meadow Dr.	Mc-Lean	22102	0	0	0	22	7	278	[Zms
Old Meadow Dr.	Mc-Lean	22102	0	0	0	23	8	278	[Zms
Old Meadow Dr.	Mc-Lean	22102	5	4	6	6	5	278	[Zms
War	Great	22066	9	7	0	9	9	411	[Zms

Admiral St	Falls								
Whisper-ing Wind Ct	Vienna	22180	1	1	1	4	1	347	[Zms
Portia Pl	Mc-Lean	22102	8	8	9	11	9	404	[Zms
Oak Valley Dr	Vienna	22180	12	8	4	5	7	451	[Zms
Richview Ct	Vienna	22180	1	1	1	1	1	462	[Zms
Cabots Point Lane	Reston	22091	2	2	1	1	2	418	[Zms
John Marshall Dr, NW	Vienna	22180	0	9	5	8	7	356	[Zms
Red Granite Terrace	Oakton	22124	0	0	0	0	0	319	[Zms
Riverben d Road	Great Falls	22066	0	6	9	12	9	530	[Zms
Oakmont Court	Oakton	22124	0	16	6	8	10	389	[Zms
Walker Road	Great Falls	22066	0	4	6	5	5	515	[Zms
Walker Road	Great Falls	22066	0	6	0	7	7	515	[Zms
Loch Lomond Drive	Vienna	22180	0	0	0	0	0	378	[Zms
Warwick-shire	Great Falls	22066	0	0	7	7	7	392	[Zms
Utterback Store Road	Great Falls	22066	0	0	0	0	0	400	[Zms
Forest Park Road	Great Falls	22066	0	0	0	0	0	406	[Zms
Daleview Drive	Mc-Lean	22101	0	0	0	0	0	422	[Zms
Old Dominion	Mc-Lean	22102	0	0	0	0	0	445	[Zms

Drive									
Constell-ation Drive	Great Falls	22066	0	0	0	0	0	459	[Zms
Galium Court	Mc-Lean	22102	0	0	0	0	0	499	[Zms
Woodside Drive	Mc-Lean	22102	0	0	0	0	0	383	[Zms
Carol Street	Great Falls	22066	0	0	0	0	0	406	[Zms
Walker Hill Lane	Great Falls	22066	0	0	0	0	0	444	[Zms
Utterback Store Road	Great Falls	22066	0	0	0	0	0	376	[Zms
Summit Drive	Fairfax	22030	0	0	0	0	0	346	[Zms
Towlston Road	Mc-Lean	22102	0	0	0	0	0	511	[Zms
Scotts Run Road	Mc-Lean	22102	0	0	0	0	0	354	[Zms
Brothers Road	Vienna	22180	0	0	0	0	0	363	[Zms
Vale Road	Oakton	22124	0	0	0	0	0	514	[Zms
Spring-vale Road	Great Falls	22066	0	0	0	0	0	363	[Zms
Coach Rd	Vienna	22180	0	0	0	0	0	345	[Zms
Besley Rd	Vienna	22180	0	0	0	0	0	371	[Zms
Leefield Drive	Hern-don	22071	0	0	0	0	0	397	[Zms
Seneca Road	Great Falls	22066	0	0	0	0	0	392	[Zms
George-town Pike	Mc-Lean	22102	0	0	0	0	0	380	[Zms
OLd Dominion Drive	Mc-Lean	22102	0	0	0	0	0	471	[Zms
Lake Winder-mere Drive	Great Falls	22066	0	0	0	0	0	386	[Zms

Saigon Road	Mc-Lean	22102	0	0	0	0	0	377	[Zms
Dixie Place, Woodside Est	Mc-Lean	22102	0	0	0	0	0	387	[Zms
Spencer Road	Mc-Lean	22102	0	0	0	0	0	388	[Zms
Sconset Lane	Mc-Lean	22102	0	0	0	0	0	401	[Zms
Seneca Road	Great Falls	22066	0	0	0	0	0	418	[Zms
Old Tolson Mill Road	Mc-Lean	22102	0	0	0	0	0	398	[Zms
Spring Hill Road	Mc-Lean	22102	0	0	0	0	0	427	[Zms
Spencer Road	Mc-Lean	22102	0	0	0	0	0	366	[Zms
Utterback Store Road	Great Falls	22066	0	0	0	0	0	381	[Zms
Old Dominion Drive	Mc-Lean	22102	0	0	0	0	0	345	[Zms
Miller Avenue	Great Falls	22066	0	0	0	0	0	356	[Zms
Constell-ation Drive	Great Falls	22066	0	0	0	0	0	477	[Zms
Warwick-shire	Great Falls	22066	0	0	0	0	0	392	[Zms
White Chimney Court	Great Falls	22066	0	0	0	0	0	453	[Zms
Woodside Drive	Mc-Lean	22102	1	2	2	2	1	399	[Zms
Seneca Road	Great Falls	22066	19	3	3	16	10	418	[Zms
Shouse Dr	Vienna	22180	4	4	3	4	4	427	[Zms
Carrhill	Vienna	22180	0	1	0	2	2	353	[Zms

Rd									
Action Dr	Reston	22091	7	5	6	0	6	403	[Zms
Fox Run Court	Vienna	22180	1	0	1	1	1	392	[Zms
Riders Lane	Reston	22091	2	1	1	2	1	298	[Zms
Thrush Ridge Road	Reston	22091	1	0	1	1	1	444	[Zms
Huntover Court	Mc-Lean	22102	0	0	3	5	4	371	[Zms
Hilling-ton Court	Vienna	22180	10	5	1	1	4	367	[Zms
Winter-green Court	Reston	22091	1	1	1	1	1	433	[Zms
Golden Eagle Drive	Reston	22094	1	1	1	2	1	362	[Zms
Spinet Court	Vienna	22180	1	1	2	5	2	458	[Zms
Handle-bar	Reston	22091	2	1	1	1	1	384	[Zms
Joy Lane	Vienna	22180	2	1	1	1	1	422	[Zms
Cream-cup La	Great Falls	22066	1	1	1	1	1	448	[Zms
Pony La	Reston	22091	0	2	3	3	3	366	[Zms
Yates Court	Mc-Lean	22101	0	1	0	1	1	286	[Zms
Glenoak Court	Vienna	22180	0	2	1	2	2	323	[Zms
Higdon Drive	Vienna	22180	0	0	0	0	0	322	[Zms
Amber-jack Ct	Reston	22091	0	0	0	0	0	377	[Zms
Clover-meadow Dr	Vienna	22180	0	0	0	0	0	415	[Zms
Fox Mill Road	Oakton	22124	0	0	0	0	0	389	[Zms
Holly Leaf Dr.	Mc-Lean	22102	0	0	0	0	0	382	[Zms
Summit	Fairfax	22030	0	0	0	0	0	338	[Zms

Drive									
Berryland Drive	Oakton	22124	0	0	0	0	0	455	[Zms
Keithley Drive	Great Falls	22066	13	15	4	8	10	420	C
Dower House Drive	Hern-don	22071	2	2	1	0	2	336	C
Horton Hill Road	Hern-don	22071	2	2	1	1	2	301	C
Dower House Drive	Hern-don	22071	1	1	1	2	1	325	C
John Milton Drive	Hern-don	22071	2	2	1	2	2	300	C
John Milton Drive	Hern-don	22071	0	0	0	0	0	311	C
Grey Squirrel Lane	Reston	22094	1	2	2	1	2	341	C
Reign Court	Hern-don	22071	2	1	2	2	2	293	C
Liz Court	Hern-don	22071	1	1	1	1	1	283	C
Grey Squirrel Lane	Reston	22094	0	2	2	4	3	342	C
Washing-ton Brice Rd	Fairfax	22033	3	2	3	4	3	287	C
Keithley Drive	Great Falls	22066	9	8	2	4	6	420	C
Mariner Lane	Fairfax	22033	0	1	1	2	1	333	C
Mary Powell Lane	Hern-don	22071	3	3	2	3	2	285	C
Dower House Drive	Hern-don	22071	3	0	3	1	2	333	C
Heritage	Hern-	22071	15	19	16	19	17	278	C

Farm Court	don								
Keithley Dr	Great Falls	22066	2	2	2	2	2	420	C
Keithley Dr	Grt Falls	22066	4	4	3	4	4	420	C
Keithley Dr	Great Falls	22066	2	1	2	2	2	420	C
Heritage Farm Court	Hern-don	22071	0	0	0	0	0	278	C
Black-berry Lane	Great Falls	22066	0	0	0	0	0	460	[Zmg
Beach Mill Road	Great Falls	22066	6	4	5	6	5	397	[Zmg
Spring-vale Road	Great Falls	22066	19	13	7	11	13	375	[Zmg
Spring-vale Road	Great Falls	22066	0	0	4	4	4	381	[Zmg
Falcon Ridge Road	Great Falls	22066	7	0	0	13	10	428	[Zmg
Down Patrick La	Great Falls	22066	1	0	5	2	3	412	[Zmg
Patowma ck Dr.	Great Falls	22066	0	0	0	0	0	441	[Zmg
Beach Mill Road	Great Falls	22066	0	0	0	0	0	422	[Zmg
Sagamore Spring Road	Great Falls	22066	0	0	0	0	0	417	[Zmg
Beach Mill Road	Great Falls	22066	0	0	0	0	0	397	[Zmg
Cup Leaf Holly Court	Great Falls	22066	3	0	2	3	3	457	S
Pellow Circle	Hern-don	22070	8	0	4	6	6	411	S

Trail									
Jefferson Run Road	Great Falls	22066	3	2	4	4	3	403	[Zms
Boyle Lane	Mc-Lean	22102	17	15	9	10	13	313	Water
Boyle Lane	Mc-Lean	22102	12	12	4	0	9	313	Water
River-crest Drive	Mc-Lean	22101	0	0	0	0	0	354	Water
Crest Lane	Mc-Lean	22101	0	3	0	0	3	267	Water
Yarnick Road	Great Falls	22066	0	0	0	0	0	362	Water
Boyle Lane	Mc-Lean	22102	1	1	1	2	1	313	Water

Source: Mose, D.G. (1987). Summary of A 1984 – 1987 study of soil radon, permeability and indoor radon, Geology Department, George Mason University, Fairfax, VA.

Appendix 3: Definition of Geostatistics Terms

Autocorrelation: statistical correlation between spatial random variables of the same type, attribute, name, and so on, where the correlation depends on the distance and/or direction that separates the locations. (Page 18).

Confidence Intervals: the range within which 95% or 99% or 99.9% of measurements of this sort would be expected to fall. (Page 41).

Correlation: covariance that is scaled so that values range from -1, when variables vary opposite of each other, to 1 when they vary together. (Page 19).

Histogram: is a way of summarizing data that are measured on an interval scale (either discrete or continuous). It is often used in exploratory data analysis to illustrate the major features of the distribution of the data in a convenient form. It divides up the range of possible values in a data set into classes or groups. A histogram can also help detect any unusual observations (outliers) or any gaps in the data set. (Page 31).

Interquartile Range: length of the box is thus the interquartile range of the sample. The box length gives an indication of the sample variability and the line across the box shows where the sample is centered. The position of the box in its whiskers and the position of the line in the box also tell us whether the sample is symmetric or skewed, either to the right or left. (Page 42).

Mean: the arithmetic average of the data and provides a measure of the center of the distribution.(Page 39).

Range: a parameter of a covariance or semivariogram model that represents a distance beyond which there is little or no autocorrelation among variables. (Page 48).

Skewness: is a measure of the symmetry of a distribution. For symmetric distributions, the coefficient of skewness is zero. The mean is larger than the median for positively skewed distributions, and vice versa for negatively skewed distributions. (Page 41).

Standard Deviation: is a measure of how spread out your data is about the mean (square root of the variance). The smaller the variance and the standard deviation, the tighter the cluster of measurements about the mean value. (Page 35).

Standard Error: the range of means that we could expect 95% or 99% or 99.9% of the time if we were to repeat the same type of measurement again and again on different samples. (Page 41).

Trend: a surface composed of fixed parameters, often polynomials of x- and y-coordinates. The nonrandom part of a spatial model describing an attribute that usually models the long-range or coarse-scale variation, leaving random errors to model the fine-scale variation. (Page 14).

Appendix 4: Expanded Explanation of Geologic Units

Kp = Potomac Formation/Lower and Upper(?). Cretaceous and light-gray to pinkish- and greenish-gray quartzo-feldspathic sand, fine-to coarse-grained, pebbly, poorly sorted, commonly thick-bedded and trough cross-bedded. Sand is interbedded with gray to green, massive to thick-bedded sandy clay and silt, commonly mottled red or reddish brown.

Mg = Greenbrier Limestone and consists of limestone, dolomite, and minor shale. Pale-brown dolomite near upper chert zone, minor dolomite locally in lower part.

Msg = Miocene Sand and Gravel. Quartz and metasiltstone are interbedded with chlorite and plagioclase-bearing metasandstone and muscovite-rich laminae; unit grades into phyllonite and mylonite in the Mountain Run fault zone.

Psg = Pliocene sand and gravel. Interbedded yellowish-orange to reddish-brown gravelly sand, sandy gravel, fine to coarse sand, poorly to well-sorted, cross-bedded in part, includes lesser amounts of clay and silt in thin to medium beds. Commonly caps drainage divides (altitude 250-170 feet) in western part of Coastal Plain.

Qsh = Shirley Formation. Light-to dark-gray, bluish-gray and brown sand, gravel, silt, clay, and peat.

Qc = Chuckatuck Formation (middle Pleistocene). Light-to medium-gray, yellowish-orange, and reddish-brown sand, silt, and clay and minor amounts of dark-brown and brownish-black peat.

Qtu = Quaternary and Tertiary deposits, undifferentiated. Tabb through Windsor Formation and alluvial/tidal prism deposits.

Qcc = Charles City Formation. Light-to medium-gray and light-to dark-yellowish and reddish-brown sand, silt, and clay composing surficial deposits of riverine terraces and coast-parallel plains at altitudes of 70 to 80 feet.

Tb1 = Bacons Castle Formation (upper Pliocene). Gray, yellowish-orange, and reddish-brown sand, gravel, silt and clay; constitutes surficial deposits of high plain extending from Richmond, eastward to the Surry scarp.

al = Alluvian (Holocene). Fine to coarse gravelly sand and sandy gravel, silt, and clay, light-to medium-gray and yellowish-gray.

of = Falls Church Intrusive Suite. Tonalite, granodiorite, monzogranite, and trondhjemite. Tonalite is typically well-foliated; in many places it has a strong quartz-rod lineation. Granodiorite is poorly- to moderately-well-foliated biotite-and biotite-muscovite-bearing.

O[o = Occoquan Granite. Light-gray, medium-to coarse-grained, muscovite-biotite monzogranite and lesser granodiorite and tonalite. In many places the rock has a strong quartz-rod lineation and two foliations locally.

O[po = Popes Head Formation. Old Mill Branch Metasiltstone. Light-greenish-gray, pale-greenish-yellow- or yellowish-gray-weathering, medium-to fine-grained micaceous metasandstone. Fine-grained beds are phyllite and micaceous metasiltstone. Graded beds are 2 to 24 cm thick.

Ops = Station Hills Phyllite. Light-greenish-gray, dusky-yellowish-weathering phyllite and lesser amounts of very fine grained metasiltstone. Beds are 2 to 12 cm thick and many have thin basal intervals of graded siltstone.

I = Indian Run Formation. Consists of poorly- to well-foliated metasedimentary mélange consisting of a medium-grained quartz-plagioclase-muscovite-biotite-chlorite-garnet matrix containing quartz “eyes” and a heterogeneous suite of olistoliths.

Za = phyllite and slate. Very-light-gray, fine-grained, bedded volcaniclastic sediments, conglomerate, lithic feldspathic arenite, micaceous sandstone, siltstone, phyllite, argillite, and vitric tuff, with minor greenstone.

Sv = Sykesville Formation. Light-to medium-grained metasedimentary mélange consisting of a quartzofeldspathic matrix that contains quartz “eyes” and a heterogeneous suite of pebble-to boulder-and larger-size olistoliths.

Zmg = Mather Gorge Formation. Metagraywacke, light-to medium-gray, yellowish-to reddish-brown-weathering, fine-to medium-grained, generally well-bedded, and lesser semi-peltic schist; contains interbedded quartzose schist and some cal-silicate rock.

Zms = Mather Gorge Formation. Schist, greenish-gray to gray, reddish-brown-weathering, fine-to coarse-grained, lustrous, quartz-rich and much lesser mica gneiss. Contains interbedded metagraywacke and some calc-silicate rock; also contains abundant mafic and ultramafic rock debris.

Zpb = Piney Branch Complex. Heterogeneous assemblage of metamorphosed peridotite, pyroxenite, and gabbro. Dominant rock-types include serpentinite, soapstone, and actinolite schist. The unit contains dikes and sheets of plagiogranite.

u = Unicoi Formation consisting of sandstone and quartzite with phyllite, tuffaceous phyllite, conglomerate, and minor basalt.

Source: Virginia Department of Mines, Minerals and Energy (VDMME). (1993). Geologic Map of Virginia - Expanded Explanation, Department of Mines, Minerals and Energy, Division of Mineral Resources, Charlottesville, Virginia, pp.1- 80.

Appendix 5: Attribute Table for Seasonal Indoor Radon Measurements and Sykesville Formation Homes

STREET	TOWN	ZIP	WINT RAD	SPRG RAD	SUMR RAD	FAL RAD	AVG	AERO	GEO1
Marshall Pond Rd	Burke	22015	3	2	2	1	2	359	[sv
Bunker Woods Lane	Burke	22015	3	3	3	2	3	378	[sv
Wood Sorrel Lane	Burke	22015	2	2	3	3	3	387	[sv
Wilmette Drive	Burke	22015	6	6	4	7	6	355	[sv
Lincolnwood Drive	Burke	22015	20	17	13	13	16	458	[sv
Marquand Drive	Burke	22015	7	6	7	7	7	335	[sv
Bronte Drive	Fairfax	22032	6	5	7	10	7	398	[sv
Wood Laurel Court	Burke	22015	0	3	4	4	4	399	[sv
Eagle Landing Court	Burke	22015	3	2	2	2	2	266	[sv
Winterway Lane	Fairfax Stati	22039	2	0	2	2	2	208	[sv
Eastwood Court	Fairfax	22032	6	0	6	6	6	346	[sv
Wythal Lane	Burke	22015	1	1	1	1	1	394	[sv
Katharines Drive	Burke	22015	1	0	2	3	2	197	[sv
Falcon Lnd. Ct.	Burke	22015	4	4	4	5	4	275	[sv
Heritage Landing Rd	Burke	22015	4	0	4	3	4	266	[sv
Eagle Landing Road	Burke	22015	2	2	2	2	2	274	[sv
Natick Road	Burke	22015	4	0	4	6	5	456	[sv
Heritage Landing Ct.	Burke	22015	1	1	1	1	1	266	[sv
Wolf Run Shoals Road	Fairfax Stati	22039	1	2	2	3	2	207	[sv
Wolf Run Shoals Road	Fairfax Stati	22039	1	0	4	5	4	257	[sv
Martins	Burke	22015	0	0	1	0	1	286	[sv

Landing Ct									
Babson Court	Fairfax	22032	2	1	1	0	1	325	[sv
Lakepointe Dr	Burke	22015	4	0	0	0	4	364	[sv
Willowbrook Rd.	Fairfax	22039	3	5	4	5	4	206	[sv
Four Oaks Lane	Burke	22015	0	5	8	0	6	227	[sv
Natick Road	Burke	22015	13	9	6	8	9	448	[sv
Westport La	Burke	22015	9	0	8	8	8	372	[sv
Split Rail Lane	Fairfax Stati	22039	0	0	2	0	2	241	[sv
Sylvan Glen Lane	Fairfax Stati	22039	0	0	0	0	0	224	[sv
Sylvan Glen Lane	Fairfax Stati	22039	0	0	0	0	0	224	[sv
Sylvan Glen Lane	Fairfax Stati	22039	0	0	0	0	0	224	[sv
Split Rail Lane	Fairfax Stati	22039	0	0	0	0	0	240	[sv
Wolf Run Shoals Road	Fairfax Stati	22039	2	1	2	3	2	200	[sv
Lincolnwood Drive	Burke	22015	1	1	2	1	1	458	[sv
Byrd Drive	Fairfax City	22030	6	4	2	3	4	366	[sv
Farr Avenue	Fairfax	22030	5	5	5	2	4	389	[sv
Crest Street	Fairfax	22030	3	3	5	5	4	344	[sv
Crest Street	Fairfax	22030	0	0	0	0	0	344	[sv
Ballantrae Farm Dr.	McLean	22101	3	3	3	4	3	338	[sv
Madison Ct	McLean	22101	4	5	6	6	5	387	[sv
Shipman Lane	McLean	22101	4	3	3	4	3	405	[sv
Mintwood Dr	McLean	22101	4	4	3	5	4	366	[sv
Leeland Dr	Falls Church	22043	6	4	3	4	4	303	[sv
Leeland Dr	Falls Church	22043	0	0	2	0	2	303	[sv
Mintwood Dr	McLean	22101	26	21	0	0	24	376	[sv
Old Chesterbrook Rd	McLean	22101	14	0	0	0	14	355	[sv
Park Road	McLean	22101	5	6	4	6	5	338	[sv

Shady Lane	Falls Church	22042	3	2	2	2	2	314	[sv
Langley Lane	McLean	22101	3	2	1	0	2	270	[sv
Hitt Ave.	McLean	22101	3	3	2	0	3	373	[sv
Forest Drive	Falls Church	22046	2	2	1	1	1	289	[sv
Tennyson Drive	McLean	22101	5	3	1	2	3	302	[sv
Jenkins Lane	Falls Church	22043	2	2	5	0	3	405	[sv
Douglass Drive	McLean	22101	4	3	3	2	3	388	[sv
Baron Road	McLean	22101	3	2	2	3	3	357	[sv
Chesterfield Place	McLean	22101	2	3	1	2	2	389	[sv
Lumsden Street	McLean	22101	5	5	4	3	4	390	[sv
Caron Lane	Falls Church	22043	3	2	1	2	2	200	[sv
Venice Court	Falls Church	22043	2	1	3	3	2	218	[sv
Mayflower Drive	McLean	22101	2	2	1	2	2	321	[sv
Mayflower Drive	McLean	22101	0	0	0	0	0	325	[sv
Holyrod Drive	McLean	22101	4	4	4	6	4	421	[sv
Virginia Avenue	Falls Church	22043	1	2	1	2	1	253	[sv
Massachusetts Ave	McLean	22101	2	2	3	3	3	280	[sv
Meridan Street	Falls Church	22046	2	2	1	2	2	302	[sv
Cedarwood Lane	Falls Church	22042	0	1	2	2	2	233	[sv
Linden Lane	Falls Church	22042	2	1	1	2	2	298	[sv
Kellogg Drive	McLean	22101	6	3	1	3	3	397	[sv
Kellogg Drive	McLean	22101	0	3	0	0	3	371	[sv
Broyhill Street	McLean	22101	2	1	2	3	2	395	[sv
Massachusetts Avenue	McLean	22101	0	0	0	4	4	244	[sv
Brookhaven Drive	McLean	22101	5	7	3	3	4	395	[sv

Susquehannock Drive	McLean	22101	5	10	4	4	6	330	[sv
East Avenue	McLean	22101	0	4	2	3	3	360	[sv
Buchanan Street	McLean	22101	10	0	7	8	6	367	[sv
Broad Branch Court	McLean	22101	3	3	6	5	4	398	[sv
Old Chesterbrook Rd	McLean	22101	3	0	2	2	2	382	[sv
Tompkins Drive	McLean	22101	2	2	1	2	2	389	[sv
Powhatan Street	Arlington	22207	1	2	2	2	2	264	[sv
Fern Oak Court	McLean	22101	5	4	3	4	4	357	[sv
Elizabeth Drive	McLean	22101	3	3	3	4	3	367	[sv
Woodacre Drive	McLean	22101	2	3	2	2	2	333	[sv
Westmoreland Street	Falls Church	22046	3	4	3	4	4	290	[sv
Kirklyn Street	Falls Church	22043	3	3	3	5	3	329	[sv
Forest Lane	McLean	22101	1	0	3	4	2	301	[sv
Woodland Terrace	McLean	22101	2	0	2	2	2	314	[sv
McLean Court	McLean	22101	4	7	4	3	4	374	[sv
N. Westmoreland St.	Arlington	22213	2	4	3	4	3	383	[sv
Great Falls Street	McLean	22101	2	1	3	2	2	328	[sv
Ingleside Avenue	McLean	22101	0	0	4	6	5	372	[sv
Buena Vista Avenue	McLean	22101	2	0	1	2	2	321	[sv
Bent Twig Road	McLean	22101	5	0	3	5	4	312	[sv
Kent Street	Falls Church	22046	0	1	1	1	1	281	[sv
Orland Street	Falls Church	22043	3	4	2	2	3	298	[sv
Diplomat	Falls	22043	5	5	5	5	5	374	[sv

Court	Church								
MacArthur Drive	McLean	22101	2	2	2	3	2	259	[sv
Great Falls Street	McLean	22101	2	2	2	4	2	334	[sv
Southridge Drive	McLean	22101	2	2	2	2	2	328	[sv
Johns Road	Falls Church	22043	3	0	1	3	2	225	[sv
Chelsea Road	McLean	22101	4	5	1	4	3	307	[sv
Morrill Court	McLean	22101	2	0	1	2	2	370	[sv
Leeland Drive	Falls Church	22043	3	3	0	4	3	303	[sv
Kirby Road	McLean	22101	21	0	11	12	15	344	[sv
Kenbar Court	McLean	22101	3	4	3	3	3	253	[sv
McLean Court	McLean	22101	4	4	3	3	3	374	[sv
Barbee Street	McLean	22101	3	3	4	4	3	340	[sv
Hardy Court	McLean	22101	3	2	2	3	3	399	[sv
McLean Mews Court	McLean	22101	5	2	4	4	4	337	[sv
McFall Street	McLean	22101	1	2	1	3	2	369	[sv
McLean Drive	McLean	22101	3	0	2	2	2	369	[sv
Ivy Hill Drive	McLean	22101	2	2	1	3	2	390	[sv
Dead Run Drive	McLean	22101	5	5	5	6	5	416	[sv
Youngblood Street	McLean	22101	0	0	5	2	4	352	[sv
Ridge Road	McLean	20101	3	3	2	3	3	353	[sv
Ridge Road	McLean	20101	0	0	2	0	2	353	[sv
Chestnut Street	Falls Church	22043	3	2	2	3	2	225	[sv
Lanham Road	Falls Church	20043	1	1	2	1	1	233	[sv
Deidre Terrace	McLean	22101	4	0	0	3	4	293	[sv
Allan Avenue	Falls Church	22046	5	4	3	4	4	209	[sv
E. Columbia Street	Falls Church	22046	0	0	0	2	2	288	[sv
Natahoa Court	Falls Church	22043	2	2	2	3	2	265	[sv
Copely Lane	McLean	22101	0	0	0	0	0	348	[sv
Ridge Drive	McLean	22101	3	4	0	2	3	352	[sv

Somerset Drive	McLean	22101	5	5	3	3	4	362	[sv
Stoneham Court	McLean	22101	6	0	0	11	8	364	[sv
Dead Run Drive	McLean	22101	1	1	0	1	1	397	[sv
Fairlawn Drive	McLean	22101	3	2	0	3	3	368	[sv
Woodgate Lane	McLean	22101	5	4	6	7	5	359	[sv
Falls Place Court	Falls Church	22043	8	0	0	0	8	234	[sv
Strine Dr	Mclean	22101	2	3	3	3	3	340	[sv
B East Broad St.	Falls Church	22046	3	5	3	4	4	236	[sv
Susquehannock Dr.	McLean	22101	6	5	4	6	5	330	[sv
Fairview Ave	Mclean	22101	5	3	9	8	6	335	[sv
Valley Wood Rd	McLean	22101	1	2	0	3	2	283	[sv
Briar Ridge Road	McLean	22101	0	0	0	0	0	341	[sv
Harvey Road	McLean	22101	0	0	0	0	0	336	[sv
Ballantrae Lane	McLean	22101	1	1	1	2	1	395	[sv
Buckelew Drive	Falls Church	22046	3	2	2	2	2	207	[sv
Fairview Ave.	McLean	22101	0	0	0	0	0	335	[sv
Allan Avenue	Falls Church	22046	0	0	0	0	0	209	[sv
Deidre Terrace	McLean	22101	0	0	0	0	0	293	[sv
Georgetown Pike	McLean	22102	1	1	3	1	2	468	[sv
Georgetown Pike	McLean	22102	3	2	1	4	2	468	[sv

Source: Mose, D.G. (1987). **Source: Mose, D.G.** (1987). Summary of a 1984 – 1987 study of soil radon, permeability and indoor radon, Geology Department, George Mason University, Fairfax, VA.

Appendix 6: Attribute Table for Seasonal Indoor Radon Measurements and Pope's Head Formation Homes

STREET	TOWN	ZIP	WINT RAD	SPRNG RAD	SUMR RAD	FAL RAD	AVG	AERO	GEO1
Black Oak Drive	Fairfax	22032	4	3	2	3	3	379	O[po
Groves Lane	Fairfax	22030	6	5	3	4	5	356	O[po
Sandy Folly Ct	Fairfax Station	22039	5	6	6	6	6	399	O[po
Chestnut St. Box 29	Clifton	22024	7	6	4	5	5	325	O[po
Hamilton Drive	Fairfax	22031	6	4	2	3	4	324	O[po
Kelley Dr	Fairfax	22030	4	3	2	2	2	335	O[po
Pumphrey Drive	Fairfax	22032	3	3	3	4	3	298	O[po
St. Charles Place	Fairfax	22032	5	4	4	4	4	361	O[po
Locust Street SW	Vienna	22180	3				3	321	O[po
Kaywood Ct.	Fairfax	22032	5	3	2	1	3	323	O[po
Rockbridge Street	Vienna	22180	3	3	1	2	2	348	O[po
Rockbridge Street	Vienna	22180		2			2	348	O[po
Rockbridge Street	Vienna	22180		44			44	348	O[po
Rockbridge Street	Vienna	22180		3			3	348	O[po
Brookwood Drive	Fairfax	22030	5	4	4	5	4	443	O[po
Harmony Drive, SW	Vienna	22180	3	3	2	2	2	328	O[po
Redwood Drive	Vienna	22180	6	5	4	5	5	351	O[po
Sandy Folly Court	Fairfax Station	22039	4	3	3		3	414	O[po
Old Creek Drive	Fairfax	22032	8	8	5	7	7	364	O[po

Coleridge Drive	Fairfax	22032	6	3	2		3	342	O[po
Barkley Drive	Fairfax	22031	8	9	7	9	8	297	O[po
Arrowood St.	Fairfax	22032	4	3	3	4	3	374	O[po
Tovito Drive	Fairfax	22031		1	1	3	2	318	O[po
Arrowood Street	Fairfax	22032	2	1	1	1	2	374	O[po
Minton Drive	Fairfax	22032	3	3	3	3	3	353	O[po
Fairhill Road	Fairfax	22031	4	5	2	3	3	360	O[po
Whitacre Road	Fairfax	22032		1	2	2	2	385	O[po
Southport Lane	Fairfax	22032	4	2	3	5	3	356	O[po
Loch Linden Court	Fairfax	22032	2	1	1	2	2	359	O[po
Yater Ford Road	Fairfax Station	22039	7	6	5	6	6	303	O[po
Prince William Drive	Fairfax	22031	2	1	1	2	1	334	O[po
Herend Place	Fairfax	22032		2			2	383	O[po
Forest Avenue	Fairfax	22030	3	4	5	6	4	324	O[po
Fairfax Station Rd.	Clifton	22024	8	6	3	3	5	378	O[po
Bel Glade Street	Fairfax	22031		2	2		2	343	O[po
Coronado Terrace	Fairfax	22031	2	3	3	4	3	364	O[po
Forest Avenue	Fairfax	22030		1			1	294	O[po
Pumphrey Drive	Fairfax	22032		8	27		17	279	O[po
Pumphrey Drive	Fairfax	22032						277	O[po
Pumphrey Drive	Fairfax	22032						277	O[po
Anchor	Fairfax	22032	2	3	3	2	3	312	O[po

Court									
Split Oak Lane	Burke	22015	1	1		2	1	302	O[po
Ware Street, S.W.	Vienna	22180	1	2	2	3	2	337	O[po
Hamilton Drive	Fairfax	22031	3	4	4	3	3	298	O[po
Commonwealth Blvd.	Fairfax	22032	3	3	3	5	3	349	O[po
Old Creek Drive	Fairfax	22032	6	7	4	8	6	364	O[po
Old Creek Drive	Fairfax	22032	7	8	5	6	6	364	O[po
Commonwealth Blvd.	Fairfax	22032	8	8	5	8	7	318	O[po
Stoneleigh Court	Fairfax	22031	6	5	4	5	5	318	O[po
Hamilton Drive	Fairfax	22031	3	3	1	3	2	302	O[po
Robert Carter Road	Fairfax Station	22039	2	2	16	3	6	293	O[po
Barkley Drive	Fairfax	22031	3	2	1	2	2	316	O[po
Grovewood Way	Fairfax	22032	3	2	3	3	3	325	O[po
St. Marks Place	Fairfax	22031	5	4	3	5	4	333	O[po
Queens Brigade Dr	Fairfax	22030	3	3	2	3	2	451	O[po
DeQuincy Drive	Fairfax	22032	5	5	5	5	5	344	O[po
Arrington Drive	Fairfax Station	22039	12	12	9	10	11	299	O[po
Jackson Parkway	Vienna	22180	1	1	1	2	1	360	O[po
Ivakota Road	Clifton	22024	4		5	4	4	359	O[po
Hamilton Drive	Fairfax	22031	2	3	3	4	3	342	O[po
Pumphrey Drive	Fairfax	22032	2		4	4	3	296	O[po
Oakland Park Drive	Burke	22015	3	4	5	5	4	309	O[po

SteamboatLanding Ln	Burke	22015	5	4	5	4	4	297	O[po
Chapel View Road	Clifton	22024	9		8	7	8	264	O[po
Ayito Road, SE	Vienna	22180	1	1	1	1	1	359	O[po
St. Marks Place	Fairfax	22031	3	1	2	3	2	332	O[po
University Drive	Fairfax	22030	1		1	2	1	317	O[po
Landon Court	Fairfax	22031			3		3	372	O[po
John Turley Place	Fairfax	22032	3	2	1	2	2	330	O[po
Fireside Court	Fairfax	22032	4		3	4	4	357	O[po
Cottage Street, SW	Vienna	22180	3	1	1	3	2	325	O[po
Reeds Landing Cir.	Burke	22015	8		5	6	7	297	O[po
Carterwood Drive	Fairfax	22032	3		1	2	2	331	O[po
Calumet Grove	Fairfax	22032	6		4	6	5	364	O[po
Claridge Court	Fairfax	22032	2	3	3	3	3	302	O[po
Oak Leather Drive	Burke	22015	3		3	2	3	311	O[po
Briary Lane	Fairfax	22031	2			1	2	353	O[po
Caithness Court	Fairfax	22032	3		1	2	2	366	O[po
Santayana Drive	Fairfax	22031	3	3	2	3	3	365	O[po
Mornington Court	Fairfax	22032	5	3	6	6	5	285	O[po
Alba Place	Fairfax	22031	2	2	3	2	2	349	O[po
Clermont Landing Ct	Burke	22015	2	2	2	3	2	301	O[po
Anchor Court	Fairfax	22032	10	12	3	7	8	312	O[po
Prince William Dr.	Fairfax	22031	4	7	5	6	6	360	O[po
Chichester	Fairfax	22031	2	2	2	2	2	309	O[po

Lane									
Stallworth Court	Fairfax	22032	2	3		3	2	271	O[po
Swinburne Court	Fairfax	22031	4	4	1	3	3	387	O[po
Shingle Oak Court	Burke	22015		2		1	2	318	O[po
Bear Oak Court	Burke	22015				2	2	317	O[po
Chase Commons Ct 208	Burke	22015	7	6	8	10	8	369	O[po
Surveyors Ct	Vienna	22180	6	6	7	7	6	338	O[po
Collingham Drive	Fairfax	22032	14		21	11	15	319	O[po
Lamarre Drive	Fairfax	22030		4			4	411	O[po
Acacia Lane	Fairfax	22032	3	4	4	5	4	395	O[po
Union Camp Dr	Fairfax St	22039	4	5	4	5	5	269	O[po
Union Camp Dr	Fairfax St	22039	5	4	4	4	4	269	O[po
Haynsworth Pl	Fairfax	22031	4	8	7	6	6	331	O[po
Kelley Dr	Fairfax	22030	4	3	2	3	3	300	O[po
Headly Court	Fairfax	22032	3	3		3	3	280	O[po
Blake Lane	Fairfax	22031	6	6	6	6	6	336	O[po
Chapel Road	Clifton	22024		4	4		4	352	O[po
Carterwood Dr.	Fairfax	22032		2	1		2	335	O[po
DeQuincey Dr.	Fairfax	22032	4	4	2	3	3	322	O[po
Nantucket Ct.	Fairfax	22030	6	10	6	5	7	280	O[po
Wheatstone Dr	Fairfax	22032	2	5	4	3	3	298	O[po
Hamilton Drive	Fairfax	22031	1	1	2	2	1	297	O[po
Young's Branche Dr.	Fairfax Station	22039			10	19	15	298	O[po

Beaumont Street	Fairfax	22030	1	1	2	2	1	308	O[po
Havenner Ct.	Fairfax Station	22039	3	2	2	3	2	296	O[po
St. Marks Pl	Fairfax	22031	4	7	7	9	7	346	O[po
Red Spruce Rd.	Fairfax	22032	1	1		21	7	291	O[po
Pickett Rd	Fairfax	22032						363	O[po
Clifton Creek Dr	Clifton	22024	6	6	2	7	5	330	O[po
Clifton Creek Dr	Clifton	22024	6	6	2	7	5	330	O[po
Lamarre Dr	Fairfax	22030	9	9	10	12	10	408	O[po
Galsworth Ct	Fairfax	22032	4	3	3	3	3	357	O[po
Wheatstone Drive	Fairfax	22032		26	6	20	17	307	O[po
Clara Way	Fairfax Station	22039		7	7		7	329	O[po
Beech Ridge Drive	Fairfax	22030						358	O[po
Yates Ford Road	Clifton	22024						271	O[po
Main Street, Box 172	Clifton	22024						311	O[po
Colchester Road	Fairfax Station	22039						392	O[po
Split Oak Lane	Burke	22015						302	O[po
Fairfax Station Road	Fairfax Station	22039						268	O[po
Burnside Landing Drive	Burke	22015						324	O[po
Barkley Drive	Fairfax	22031	1	1	2	1	1	297	O[po
Old Creek Drive	Fairfax	22032	2	1	2	4	2	364	O[po
Anchor Ct	Fairfax	22032	4		1		2	312	O[po
Stoneleigh Ct	Fairfax	22031	1	1	1	1	1	318	O[po
Wheatstone Dr	Fairfax	22032		2	1	1	2	298	O[po

Youngs Branch Dr	Fairfax Station	22039		1	1	2	1	289	O[po
Arrington Dr	Fairfax Station	22039						299	O[po
Collingham Dr	Fairfax	22032						319	O[po
Haynesworth Place	Fairfax	22031						331	O[po

Source: Mose, D.G. (1987). Summary of A 1984 – 1987 study of soil radon, permeability and indoor radon, Geology Department, George Mason University, Fairfax, VA.

Appendix 7: Attribute Table for Seasonal Indoor Radon Measurements and Mather Gorge Formation Homes

STREET	TOWN	ZIP	WINT RAD	SPRNG RAD	SUMR RAD	FAL RAD	AVG	AERO	GEO1
Laurel Glen Road	Clifton	22024	3	3	3	5	4	292	[Zms
Laurel Glen Road	Clifton	22024	1	1	2	2	1	287	[Zms
Clifton Road	Clifton	22024	0	0	0	0	0	339	[Zms
Fox Run Ct	Vienna	22180	3	2	2	2	2	392	[Zms
Springvale Rd	Great Falls	22066	3	2	1	4	2	374	[Zms
Willow Dr	Vienna	22180	2	2	1	0	2	328	[Zms
Shouse Dr	Vienna	22180	7	4	5	5	5	427	[Zms
Bellmont Dr	Fairfax	22030	10	7	4	5	6	406	[Zms
Park Street SE	Vienna	22180	5	3	2	4	3	358	[Zms
Quail Ridge Ct	Reston	22094	12	11	5	1	7	438	[Zms
Battle Street SW	Vienna	22180	2	0	1	1	1	378	[Zms
Westwood Hills Dr	Herndon	22071	3	2	1	2	2	388	[Zms
Mt. Sunapec Road	Vienna	22180	3	7	5	0	5	435	[Zms
Glencoe Drive	Vienna	22180	3	3	2	2	2	333	[Zms
Golden Eagle Drive	Reston	22094	6	6	3	4	4	362	[Zms
Waters Edge Lane	Reston	22090	4	1	1	2	2	402	[Zms
Railroad Court	Fairfax	22030	2	1	1	2	1	361	[Zms
Brook Rd	McLean	22102	6	4	2	3	4	425	[Zms
Brook Rd	McLean	22102	3	3	0	0	3	425	[Zms
Belleview Rd	McLean	22102	4	0	0	0	4	401	[Zms
Berryland Court	Oakton	22124	3	2	0	0	3	457	[Zms
Carnegie Dr	Vienna	22180	15	10	0	0	12	339	[Zms
Challedon Road	Great Falls	22066	10	9	4	4	6	380	[Zms
Challedon Road	Great Falls	22066	0	3	0	0	3	380	[Zms

Rockport Rd	Vienna	22180	3	1	3	1	2	342	[Zms
Briggs Road	Fairfax	22030	7	6	3	6	6	332	[Zms
Telfer Court	Vienna	22180	5	4	3	2	3	367	[Zms
Handlebar Rd	Reston	22091	3	2	4	4	3	384	[Zms
Holyview Dr	Great Falls	22066	6	3	1	0	3	428	[Zms
Barton Hill Road	Reston	22091	7	7	3	3	5	474	[Zms
Barton Hill Road	Reston	22091	0	0	3	0	3	474	[Zms
Creamcup Lane	Great Falls	22066	6	4	2	5	4	448	[Zms
Spring Side Way	McLean	22101	6	3	5	6	5	314	[Zms
Rich Meadow Drive	Great Falls	22066	3	4	5	5	4	360	[Zms
Foxhound Rd	McLean	22102	5	6	5	8	6	426	[Zms
Georgetown Pike	McLean	22102	2	1	1	2	1	379	[Zms
Titania Lane	McLean	22102	3	2	0	4	3	409	[Zms
Old Cedar Road	McLean	22102	6	4	3	3	4	396	[Zms
Rocky Run Road	McLean	22102	4	5	4	8	5	453	[Zms
Constellation Dr.	Great Falls	22066	15	9	6	8	10	519	[Zms
Constellation Dr.	Great Falls	22066	0	2	0	0	2	519	[Zms
Chain Bridge Road	Vienna	22180	1	1	2	2	2	271	[Zms
Vale Road	Oakton	22124	36	23	1	3	16	424	[Zms
Birnam Wood Drive	McLean	22102	4	4	4	6	4	411	[Zms
Orchid Circle	Great Falls	22066	10	9	5	7	8	438	[Zms
Turtle Pond Dr.	Reston	22091	4	2	0	4	3	383	[Zms
Turtle Pond Dr.	Reston	22091	0	0	0	0	0	383	[Zms
Georgetown Pike	Great Falls	22066	4	2	1	2	2	474	[Zms
Georgetown	Great	22066	0	0	0	0	0	474	[Zms

Pike	Falls								
Carrhill Road	Vienna	22180	5	4	4	5	4	353	[Zms
Wintergreen Court	Reston	22091	9	8	4	6	7	433	[Zms
Chadds Ford Drive	Reston	22091	4	3	2	2	3	355	[Zms
Golden Eagle Drive	Reston	22094	13	11	6	11	10	362	[Zms
Cross School Road	Reston	22091	14	12	4	0	10	430	[Zms
Stirrup Road	Reston	22091	8	5	5	5	6	291	[Zms
Quail Ridge Drive	Reston	22094	5	3	3	4	4	376	[Zms
Brooktrail Ct.	Vienna	22180	5	7	10	7	7	346	[Zms
Pony Lane	Reston	22091	7	5	5	5	5	366	[Zms
Pony Lane	Reston	22091	5	6	5	3	5	366	[Zms
Silentree Drive	Vienna	22180	12	9	5	7	8	271	[Zms
Silentree Drive	Vienna	22180	0	0	0	0	0	272	[Zms
Full Cry Court	Oakton	22124	3	2	3	0	2	482	[Zms
Full Cry Court	Oakton	22124	0	3	0	0	3	483	[Zms
Homer Terrace	Reston	22091	5	4	3	5	4	370	[Zms
Spinet Court	Vienna	22180	12	9	5	7	8	458	[Zms
Decade Street	Reston	22091	4	3	4	0	3	328	[Zms
Old Bayberry Lane	Reston	22091	4	3	2	0	3	351	[Zms
Acton Drive	Reston	22091	10	10	7	0	9	403	[Zms
Deer Forest Road	Reston	22094	7	7	3	6	6	375	[Zms
Rich Meadow Drive	Great Falls	22066	2	2	1	2	2	360	[Zms
Quail Ridge Court	Reston	22094	9	8	5	10	8	428	[Zms
Hunter Mill Road	Vienna	22180	3	1	1	2	2	325	[Zms
Burch Pond Lane	Fairfax	22033	2	1	1	0	1	346	[Zms
Triple Crown Rd.	Reston	22091	3	2	2	2	2	333	[Zms
Turtle Pond Drive	Reston	22091	2	2	2	0	2	384	[Zms
Walker Road	Great Falls	22066	2	3	4	4	3	476	[Zms

Walker Road	Great Falls	22066	4	0	0	4	4	476	[Zms
Pebble Beach Drive	Vienna	22180	1	1	1	0	1	349	[Zms
Auburn Grove Court	Reston	22094	6	0	0	0	6	372	[Zms
Gouldman Lane	Great Falls	22066	5	1	4	4	3	388	[Zms
Huntmaster Lane	McLean	22102	3	3	2	0	3	324	[Zms
Foxmill Road	Oakton	22124	14	17	4	8	11	394	[Zms
Vistas Lane	McLean	22101	3	2	2	3	2	323	[Zms
Summit Drive	Fairfax	22030	4	5	7	7	6	338	[Zms
Litwalton Court	Vienna	22180	3	3	4	4	3	355	[Zms
Vistas Lane	McLean	22101	2	1	2	3	2	323	[Zms
Quail Ridge Court	Reston	22094	3	4	2	0	3	430	[Zms
Yates Court	McLean	22101	5	7	5	6	6	286	[Zms
Old Dominion Drive	McLean	22102	2	2	1	2	2	423	[Zms
Old Dominion Drive	McLean	22102	0	0	0	0	0	423	[Zms
Tanbark Drive	Reston	22091	4	2	2	2	3	424	[Zms
William Terry Drive	Vienna	22180	22	22	11	12	17	421	[Zms
Amberjack Court	Reston	22091	15	14	4	3	9	377	[Zms
Ozkan Street	McLean	22101	5	6	4	5	5	284	[Zms
Jean Place, N.E.	Vienna	22180	4	4	5	4	4	316	[Zms
Trophy Lane	Reston	22091	4	5	4	2	4	305	[Zms
Ivy Bush Court	Reston	22091	6	2	1	3	3	363	[Zms
Clover Meadow Drive	Vienna	22180	3	3	4	3	3	440	[Zms
Brevity Drive	Great Falls	22066	4	3	3	3	3	415	[Zms
Montague Drive	Vienna	22180	5	3	2	4	4	495	[Zms
Montague Drive	Vienna	22180	4	4	4	4	4	495	[Zms

Fox Mill Road	Herndon	22071	2	2	2	2	2	294	[Zms
Sawdust Road	Vienna	22180	7	7	6	6	6	415	[Zms
Golf Course Drive	Reston	22091	3	4	2	3	3	363	[Zms
Tartan Court	Vienna	22180	2	2	3	3	2	351	[Zms
Aubrey Place Court	Vienna	22180	3	3	1	2	2	443	[Zms
Aubrey Place Court	Vienna	22180	0	3	0	0	3	443	[Zms
Hill Road	Vienna	22180	6	5	3	7	5	365	[Zms
Salt Kettle Way	Reston	22091	5	3	2	3	3	407	[Zms
Cobblestone Lane	Reston	22091	8	11	7	6	8	384	[Zms
Lake Ridge Drive	Oakton	22124	3	3	4	4	3	463	[Zms
Old Dominion Dr	McLean	22102	10	10	6	8	8	384	[Zms
Northwoods Trail	McLean	22102	2	2	2	0	2	425	[Zms
Helmont Drive	Oakton	22124	4	5	3	5	4	380	[Zms
Brambelbush Court	Reston	22091	0	5	3	5	5	360	[Zms
Shouse Drive	Vienna	22180	2	2	2	2	2	407	[Zms
Bree Hill Road	Oakton	22124	0	2	3	2	2	406	[Zms
Delancey Drive	Vienna	22180	2	5	1	1	2	379	[Zms
Beekay Court	Vienna	22180	4	5	4	4	4	352	[Zms
History Drive	Oakton	22124	2	2	2	4	2	378	[Zms
Riva Ridge Drive	Great Falls	22066	0	2	2	4	2	554	[Zms
Portland Place	McLean	22102	4	5	4	5	5	338	[Zms
Riva Ridge Drive	Great Falls	22066	0	1	3	5	3	554	[Zms
Loch Lomond Drive	Vienna	22180	0	4	3	1	3	369	[Zms
Plantation Parkway	Fairfax	22030	7	7	3	5	5	375	[Zms
Spruce Avenue	Fairfax	22030	4	3	4	4	4	382	[Zms
Nottingham Drive	Falls Church	22043	1	1	1	1	1	284	[Zms

Clovermeadow Drive	Vienna	22180	8	11	7	4	7	415	[Zms
Daviswood Drive	McLean	22102	1	2	1	2	2	376	[Zms
Larkmeade Drive	Vienna	22180	1	1	2	1	1	371	[Zms
Farrier Lane	Reston	22091	5	5	4	5	5	288	[Zms
Vernon Drive	Great Falls	22066	8	9	4	6	7	555	[Zms
Brians Hill Lane	Oakton	22124	0	3	4	6	4	380	[Zms
Senseney Lane	Falls Church	22043	1	1	1	2	1	301	[Zms
Rivera Drive	Vienna	22180	1	1	1	2	1	392	[Zms
Gunnell Farms Drive	Vienna	22180	0	3	3	3	3	415	[Zms
Wilhelm Drive	Great Falls	22066	0	6	4	0	5	493	[Zms
Ranger Road	Fairfax	22030	1	1	1	2	1	390	[Zms
Berryland Drive	Oakton	22124	5	39	11	17	18	454	[Zms
Sunny Side Lane	McLean	22102	10	9	5	7	8	457	[Zms
Fox Run Court	Vienna	22180	6	5	2	5	4	392	[Zms
Del Rio Drive	Fairfax	22030	2	2	2	2	2	364	[Zms
Birnam Wood Drive	McLean	22102	8	9	6	8	8	386	[Zms
William Terry Drive	Vienna	22180	9	10	5	6	7	421	[Zms
William Terry Drive	Vienna	22180	10	10	6	8	8	421	[Zms
Amberjack Court	Reston	22091	6	10	10	3	7	377	[Zms
Amberjack Court	Reston	22091	9	11	6	4	8	377	[Zms
Paddock Lane	Reston	22091	7	5	7	8	7	295	[Zms
St. Roman Drive	Vienna	22180	3	5	3	4	4	366	[Zms
Georgetown Pike	Great Falls	22066	1	2	1	2	2	474	[Zms
Wild Cherry Place	Reston	22091	0	0	0	0	0	296	[Zms

Harriman Street	Great Falls	22066	8	7	5	7	7	488	[Zms
Riders Lane	Reston	22091	4	4	3	0	4	298	[Zms
Marymead Drive	Fairfax	22030	3	4	2	3	3	384	[Zms
Lewinsville Road	McLean	22102	5	0	2	4	4	375	[Zms
Hatmark Court	Vienna	22180	3	3	3	3	3	355	[Zms
Dogwood Street, SW	Vienna	22180	2	2	3	2	2	370	[Zms
Evans Mill Road	McLean	22101	0	0	3	0	3	307	[Zms
Cedar Lane	Vienna	22180	0	0	2	0	2	305	[Zms
Walker Road	Great Falls	22066	8	6	9	7	8	525	[Zms
Snowberry Court	Vienna	22180	3	3	2	2	2	318	[Zms
Fowlers Lane	Reston	22091	5	7	5	7	6	299	[Zms
Concert Court	Vienna	22180	2	0	3	3	3	397	[Zms
Flemish Mill Court	Oakton	22124	4	3	3	3	3	444	[Zms
Hunter Mill Road	Vienna	22180	7	7	9	10	8	392	[Zms
Westwod Hills Drive	Herndon	22071	3	0	2	3	2	409	[Zms
Marcliff Court	Vienna	22180	2	2	2	3	2	375	[Zms
Titania Lane	McLean	22102	2	0	3	4	3	413	[Zms
Leigh Mill Road	Great Falls	22066	2	0	3	5	3	446	[Zms
Arnon Meadow Road	Great Falls	22066	4	0	3	3	3	440	[Zms
Old Dominion Drive	McLean	22102	4	3	2	2	3	324	[Zms
Brook Road	McLean	22102	2	0	2	2	2	344	[Zms
Indian Ridge Road	Reston	22091	2	1	1	1	1	360	[Zms
Mediterranean Court	Reston	20090	3	3	2	4	3	369	[Zms
Hunter Station Road	Vienna	22180	25	3	27	24	19	449	[Zms
Waythorn Place	Fairfax	22033	1	1	3	2	2	285	[Zms

Georgetown Pike	Great Falls	22066	6	7	2	5	5	452	[Zms
Full Cry Court	Oakton	22124	4	0	3	5	4	482	[Zms
Samaga Drive	Oakton	22124	16	22	11	12	15	470	[Zms
O'Faly Road	Fairfax	22030	4	4	4	5	4	434	[Zms
Red Leaf Court	Reston	22091	7	7	7	10	8	332	[Zms
Waples Mill Road	Oakton	22124	6	7	6	9	7	406	[Zms
Blythe Dale Court	Vienna	22180	4	3	3	5	3	421	[Zms
Deer Forest Road	Reston	22094	6	7	4	5	6	445	[Zms
Adhoc Road	Great Falls	22066	5	0	4	4	4	457	[Zms
Portia Place	McLean	22102	2	3	3	3	3	404	[Zms
Edgepark Road	Vienna	22180	20	0	10	11	14	529	[Zms
Sourwood Lane	Reston	22091	4	2	7	5	5	306	[Zms
Huntover Court	McLean	22102	8	1	9	8	6	371	[Zms
Mary Ellen Court	McLean	22101	0	0	0	0	0	328	[Zms
Bennington Woods Rd	Reston	22094	2	0	3	3	3	337	[Zms
Octagon Court	Fairfax	22030	5	0	3	4	4	393	[Zms
Matthew Mills Road	McLean	22101	2	2	2	2	2	337	[Zms
Burywood Lane	Reston	22090	5	4	4	5	5	416	[Zms
Sabastian Drive	Fairfax	22030	4	3	3	5	4	391	[Zms
Higdon Drive	Vienna	22180	5	6	3	4	4	322	[Zms
Batten Hollow Road	Vienna	22180	5	0	8	17	10	355	[Zms
Hounds Lane	Reston	22091	3	4	2	3	3	290	[Zms
Villanova Drive	Vienna	22180	4	0	3	4	3	327	[Zms
Fairway Drive, NE	Vienna	22180	2	2	2	3	2	387	[Zms
Hillington	Vienna	22180	5	4	2	5	4	367	[Zms

Court									
Asoleado Lane	Vienna	22180	3	0	3	3	3	445	[Zms
Holly Leaf Drive	McLean	22102	0	2	0	3	2	388	[Zms
Blue Coat Drive	Fairfax	22030	2	3	4	3	3	395	[Zms
Blue Coat Drive	Fairfax	22030	4	2	3	2	3	395	[Zms
Clovermeadow Drive	Vienna	22180	13	15	10	13	13	415	[Zms
Whisperwood Glen Ln	Reston	22091	1	1	5	2	2	421	[Zms
Joy Lane	Vienna	22180	6	6	0	5	5	422	[Zms
Van Dusen Court	Great Falls	22066	6	1	2	7	4	483	[Zms
Paddock Lane	Reston	22091	4	5	4	3	4	277	[Zms
Old Courthouse Road	Vienna	22180	13	4	2	13	8	422	[Zms
Fosbak Drive	Vienna	22180	4	4	5	5	5	422	[Zms
Sandra Lane	Fairfax	22030	2	0	0	2	2	325	[Zms
Pommel Court	Oakton	22124	0	0	0	0	0	369	[Zms
Foxstone Drive	Vienna	22180	0	3	0	3	2	318	[Zms
Purple Beech Drive	Reston	22091	3	2	0	3	3	382	[Zms
Mill Street, SE	Vienna	22180	0	2	2	2	2	309	[Zms
Glenoak Court	Vienna	22180	9	7	8	12	9	323	[Zms
Trenholm Drive	Oakton	22124	11	11	0	18	13	464	[Zms
Bennington Woods Rd	Reston	22094	5	0	0	6	5	337	[Zms
Ivystone Ct. - 100	Reston	22091	1	3	4	0	3	367	[Zms
Aubrey Place Court	Vienna	22180	2	3	3	5	3	443	[Zms
Sawdust Road	Vienna	22180	14	12	5	4	9	405	[Zms
Burgee Court	Reston	22091	2	2	3	2	2	416	[Zms
Tazewell Road, NW	Vienna	22180	5	8	6	4	6	361	[Zms
Fox Mill Road	Oakton	22124	1	1	2	2	2	389	[Zms
Golf Course	Reston	22091	0	1	1	0	1	357	[Zms

Drive									
Sawdust Road	Vienna	22180	3	4	5	7	5	406	[Zms
Litwalton Court	Vienna	22180	2	2	3	3	2	355	[Zms
Northwoods Trail	McLean	22102	3	3	3	4	3	427	[Zms
Hunters Valley Rd.	Vienna	22180	19	20	13	7	15	409	[Zms
Masterworks drive	Vienna	22180	0	1	0	1	1	412	[Zms
Masterworks drive	Vienna	22180	0	3	0	2	2	412	[Zms
Holly Leaf Dr	McLean	22102	3	4	2	3	3	382	[Zms
Blythe Dale Ct	Vienna	22180	2	2	1	1	2	421	[Zms
Turf Lane	Reston	22091	3	5	5	3	4	307	[Zms
Holly Leaf Drive	McLean	22102	4	4	4	7	5	396	[Zms
Quail Ridge Drive	Reston	22094	0	2	3	4	3	378	[Zms
Darrow Court	Vienna	22180	2	4	3	3	3	378	[Zms
Samaga Drive	Oakton	22124	0	0	0	0	0	422	[Zms
Hunter Station Rd.	Vienna	22180	1	1	3	2	2	449	[Zms
Rock Manor Ct.	Herndon	22071	7	8	5	10	8	330	[Zms
Oxfordshire RD.	Great Falls	22066	0	0	0	0	0	523	[Zms
Birnam Wood Dr.	McLean	22102	5	5	0	5	5	411	[Zms
Golden Eagle Dr	Reston	22094	6	5	6	7	6	362	[Zms
Clovermeadow Dr	Vienna	22180	6	6	0	4	5	415	[Zms
Clovermeadow Dr	Vienna	22180	0	6	0	5	5	415	[Zms
Purple Beech Dr.	Reston	22091	3	6	5	6	5	352	[Zms
Purple Beech Drive	Reston	22091	5	19	6	17	12	352	[Zms
Northwoods Terrace	McLean	22102	3	0	0	2	3	417	[Zms
Northwoods	McLean	22102	0	0	2	0	2	417	[Zms

Terrace									
Georgetown Pike	Mclean	22102	2	3	2	2	2	373	[Zms
Foxhound Road	McLean	22102	0	0	5	3	4	426	[Zms
Berryland Dr	Oakton	22124	6	3	6	9	6	455	[Zms
Old Meadow Dr.	McLean	22102	0	0	0	22	7	278	[Zms
Old Meadow Dr.	McLean	22102	0	0	0	23	8	278	[Zms
Old Meadow Dr.	McLean	22102	5	4	6	6	5	278	[Zms
War Admiral St	Great Falls	22066	9	7	0	9	9	411	[Zms
Whispering Wind Ct	Vienna	22180	1	1	1	4	1	347	[Zms
Portia Pl	McLean	22102	8	8	9	11	9	404	[Zms
Oak Valley Dr	Vienna	22180	12	8	4	5	7	451	[Zms
Richview Ct	Vienna	22180	1	1	1	1	1	462	[Zms
Cabots Point Lane	Reston	22091	2	2	1	1	2	418	[Zms
John Marshall Dr, NW	Vienna	22180	0	9	5	8	7	356	[Zms
Red Granite Terrace	Oakton	22124	0	0	0	0	0	319	[Zms
Riverbend Road	Great Falls	22066	0	6	9	12	9	530	[Zms
Oakmont Court	Oakton	22124	0	16	6	8	10	389	[Zms
Walker Road	Great Falls	22066	0	4	6	5	5	515	[Zms
Walker Road	Great Falls	22066	0	6	0	7	7	515	[Zms
Loch Lomond Drive	Vienna	22180	0	0	0	0	0	378	[Zms
Warwickshire	Great Falls	22066	0	0	7	7	7	392	[Zms
Utterback Store Road	Great Falls	22066	0	0	0	0	0	400	[Zms
Forest Park Road	Great Falls	22066	0	0	0	0	0	406	[Zms
Daleview	McLean	22101	0	0	0	0	0	422	[Zms

Drive									
Old Dominion Drive	McLean	22102	0	0	0	0	0	445	[Zms
Constellation Drive	Great Falls	22066	0	0	0	0	0	459	[Zms
Galium Court	McLean	22102	0	0	0	0	0	499	[Zms
Woodside Drive	McLean	22102	0	0	0	0	0	383	[Zms
Carol Street	Great Falls	22066	0	0	0	0	0	406	[Zms
Walker Hill Lane	Great Falls	22066	0	0	0	0	0	444	[Zms
Utterback Store Road	Great Falls	22066	0	0	0	0	0	376	[Zms
Summit Drive	Fairfax	22030	0	0	0	0	0	346	[Zms
Towlston Road	McLean	22102	0	0	0	0	0	511	[Zms
Scotts Run Road	McLean	22102	0	0	0	0	0	354	[Zms
Brothers Road	Vienna	22180	0	0	0	0	0	363	[Zms
Vale Road	Oakton	22124	0	0	0	0	0	514	[Zms
Springvale Road	Great Falls	22066	0	0	0	0	0	363	[Zms
Coach Rd	Vienna	22180	0	0	0	0	0	345	[Zms
Besley Rd	Vienna	22180	0	0	0	0	0	371	[Zms
Leefield Drive	Herndon	22071	0	0	0	0	0	397	[Zms
Seneca Road	Great Falls	22066	0	0	0	0	0	392	[Zms
Georgetown Pike	McLean	22102	0	0	0	0	0	380	[Zms
OLd Dominion Drive	McLean	22102	0	0	0	0	0	471	[Zms
Lake Windermere Drive	Great Falls	22066	0	0	0	0	0	386	[Zms
Saigon Road	McLean	22102	0	0	0	0	0	377	[Zms
Dixie Place, Woodside	McLean	22102	0	0	0	0	0	387	[Zms
Spencer Road	McLean	22102	0	0	0	0	0	388	[Zms
Sconset Lane	McLean	22102	0	0	0	0	0	401	[Zms
Seneca Road	Great	22066	0	0	0	0	0	418	[Zms

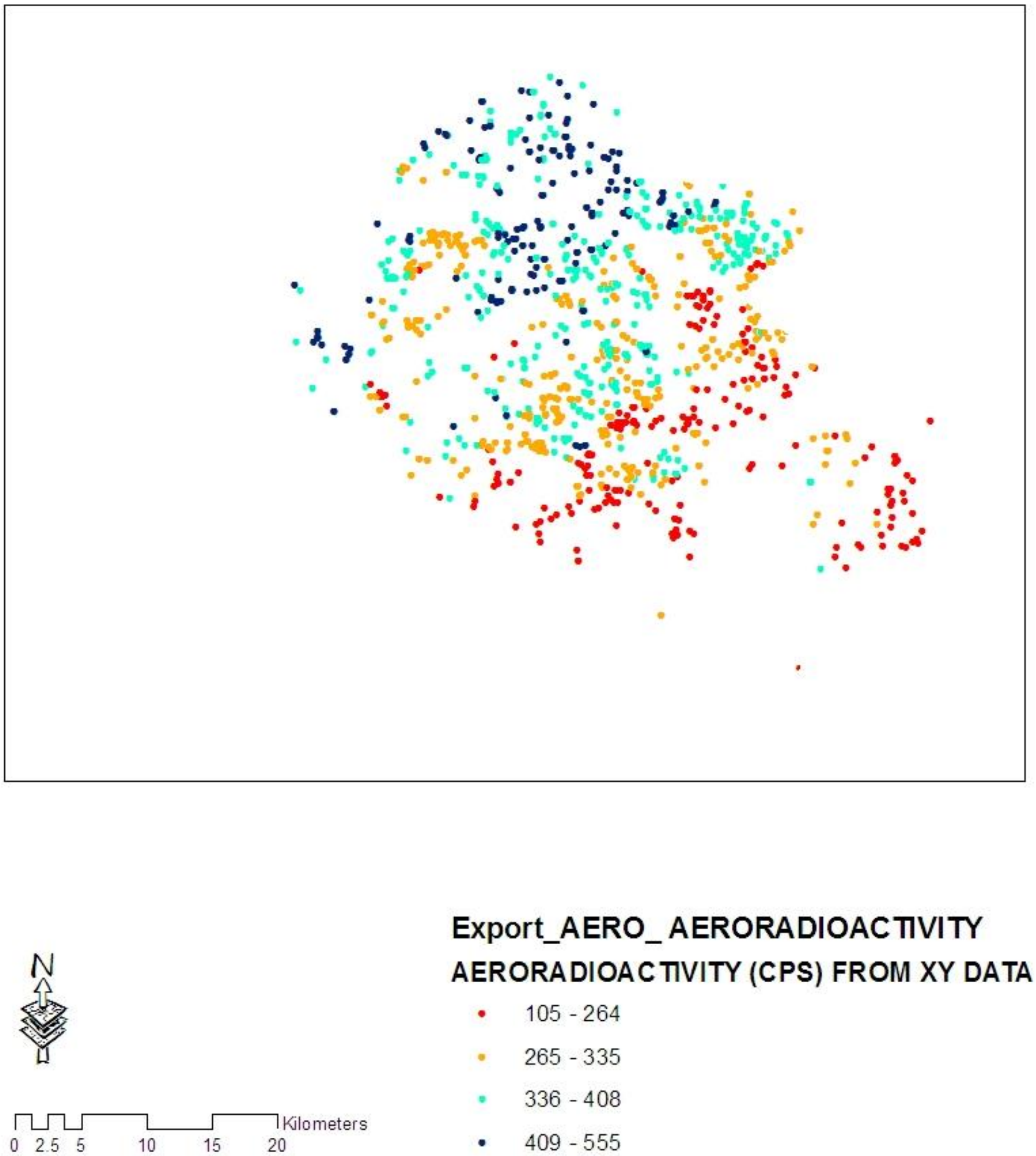
	Falls								
Old Tolson Mill Road	McLean	22102	0	0	0	0	0	398	[Zms
Spring Hill Road	McLean	22102	0	0	0	0	0	427	[Zms
Spencer Road	McLean	22102	0	0	0	0	0	366	[Zms
Utterback Store Road	Great Falls	22066	0	0	0	0	0	381	[Zms
OLd Dominion Drive	McLean	22102	0	0	0	0	0	345	[Zms
Miller Avenue	Great Falls	22066	0	0	0	0	0	356	[Zms
Constellation Drive	Great Falls	22066	0	0	0	0	0	477	[Zms
Warwickshire	Great Falls	22066	0	0	0	0	0	392	[Zms
White Chimney Court	Great Falls	22066	0	0	0	0	0	453	[Zms
Woodside Drive	McLean	22102	1	2	2	2	1	399	[Zms
Seneca Road	Great Falls	22066	19	3	3	16	10	418	[Zms
Shouse Dr	Vienna	22180	4	4	3	4	4	427	[Zms
Carrhill Rd	Vienna	22180	0	1	0	2	2	353	[Zms
Action Dr	Reston	22091	7	5	6	0	6	403	[Zms
Fox Run Court	Vienna	22180	1	0	1	1	1	392	[Zms
Riders Lane	Reston	22091	2	1	1	2	1	298	[Zms
Thrush Ridge Road	Reston	22091	1	0	1	1	1	444	[Zms
Huntover Court	McLean	22102	0	0	3	5	4	371	[Zms
Hillington Court	Vienna	22180	10	5	1	1	4	367	[Zms
Wintergreen Court	Reston	22091	1	1	1	1	1	433	[Zms
Golden Eagle Drive	Reston	22094	1	1	1	2	1	362	[Zms
Spinet Court	Vienna	22180	1	1	2	5	2	458	[Zms
Handlebar	Reston	22091	2	1	1	1	1	384	[Zms
Joy Lane	Vienna	22180	2	1	1	1	1	422	[Zms

Creamcup La	Great Falls	22066	1	1	1	1	1	448	[Zms
Pony La	Reston	22091	0	2	3	3	3	366	[Zms
Yates Court	McLean	22101	0	1	0	1	1	286	[Zms
Glenoak Court	Vienna	22180	0	2	1	2	2	323	[Zms
Higdon Drive	Vienna	22180	0	0	0	0	0	322	[Zms
Amberjack Ct	Reston	22091	0	0	0	0	0	377	[Zms
Clovermeadow Dr	Vienna	22180	0	0	0	0	0	415	[Zms
Fox Mill Road	Oakton	22124	0	0	0	0	0	389	[Zms
Holly Leaf Dr.	McLean	22102	0	0	0	0	0	382	[Zms
Summit Drive	Fairfax	22030	0	0	0	0	0	338	[Zms
Berryland Drive	Oakton	22124	0	0	0	0	0	455	[Zms
Jefferson Run Road	Great Falls	22066	3	2	4	4	3	403	[Zms
Hunt Road	Oakton	22124	22	10	9	6	12	456	[Zmg
Hunt Road	Oakton	22124	8	6	5	4	6	456	[Zmg
Hunt Road	Oakton	22124	11	7	5	6	7	456	[Zmg
Hunt Road	Oakton	22124	0	3	3	5	4	440	[Zmg
Hunt Rd	Oakton	22124	1	1	1	1	1	456	[Zmg
Spinnaker Court	Reston	22091	19	25	8	8	15	427	[Zmg
Glade Drive	Reston	22091	5	4	3	0	4	492	[Zmg
Clarks Landing Dr.	Oakton	22124	5	3	3	3	3	424	[Zmg
Spinnaker Court	Reston	22091	4	3	2	3	3	427	[Zmg
Timberline Ct	Oakton	22124	2	1	1	2	1	386	[Zmg
Birdfoot Lane	Reston	22091	6	3	3	3	4	429	[Zmg
Spinnaker	Reston	22091	2	5	3	3	3	427	[Zmg
Hunters Crest Way	Vienna	22124	32	24	1	41	25	415	[Zmg
Freetown Drive	Reston	22091	3	3	5	5	4	277	[Zmg
Freetown Drive	Reston	22091	0	0	0	0	0	287	[Zmg
Burford Drive	McLean	22102	6	3	4	6	5	388	[Zmg
Old Dominion Drive	McLean	22102	5	4	3	0	4	357	[Zmg
Potomac Falls Road	McLean	22102	1	1	2	2	2	319	[Zmg

Falstaff Road	Mclean	22102	5	7	3	4	4	368	[Zmg
Elsinore Ave.	McLean	22102	5	5	2	3	3	394	[Zmg
Swinks Mill Road	McLean	22102	3	0	3	4	3	410	[Zmg
Tebbs Lane	McLean	22102	0	0	0	0	0	431	[Zmg
Tebbs Lane	McLean	22102	0	0	0	0	0	430	[Zmg
Colvin Forest Drive	Vienna	22180	2	1	0	0	1	477	[Zmg
Millwood Lane	Great Falls	22066	3	3	4	5	4	421	[Zmg
Fringertree Road	Great Falls	22066	0	0	0	0	0	408	[Zmg
Jeffery Road	Great Falls	22066	0	0	0	0	0	354	[Zmg
Blackberry Lane	Great Falls	22066	0	0	0	0	0	460	[Zmg
Beach Mill Road	Great Falls	22066	6	4	5	6	5	397	[Zmg
Springvale Road	Great Falls	22066	19	13	7	11	13	375	[Zmg
Springvale Road	Great Falls	22066	0	0	4	4	4	381	[Zmg
Falcon Ridge Road	Great Falls	22066	7	0	0	13	10	428	[Zmg
Down Patrick La	Great Falls	22066	1	0	5	2	3	412	[Zmg
Patowmack Dr.	Great Falls	22066	0	0	0	0	0	441	[Zmg
Beach Mill Road	Great Falls	22066	0	0	0	0	0	422	[Zmg
Sagamore Spring Road	Great Falls	22066	0	0	0	0	0	417	[Zmg
Beach Mill Road	Great Falls	22066	0	0	0	0	0	397	[Zmg

Source: Mose, D.G. (1987). Summary of A 1984 – 1987 study of soil radon, permeability and indoor radon, Geology Department, George Mason University, Fairfax, VA.

Appendix 8a. Aeroradioactivity of Fairfax County (Duvall, 1989)

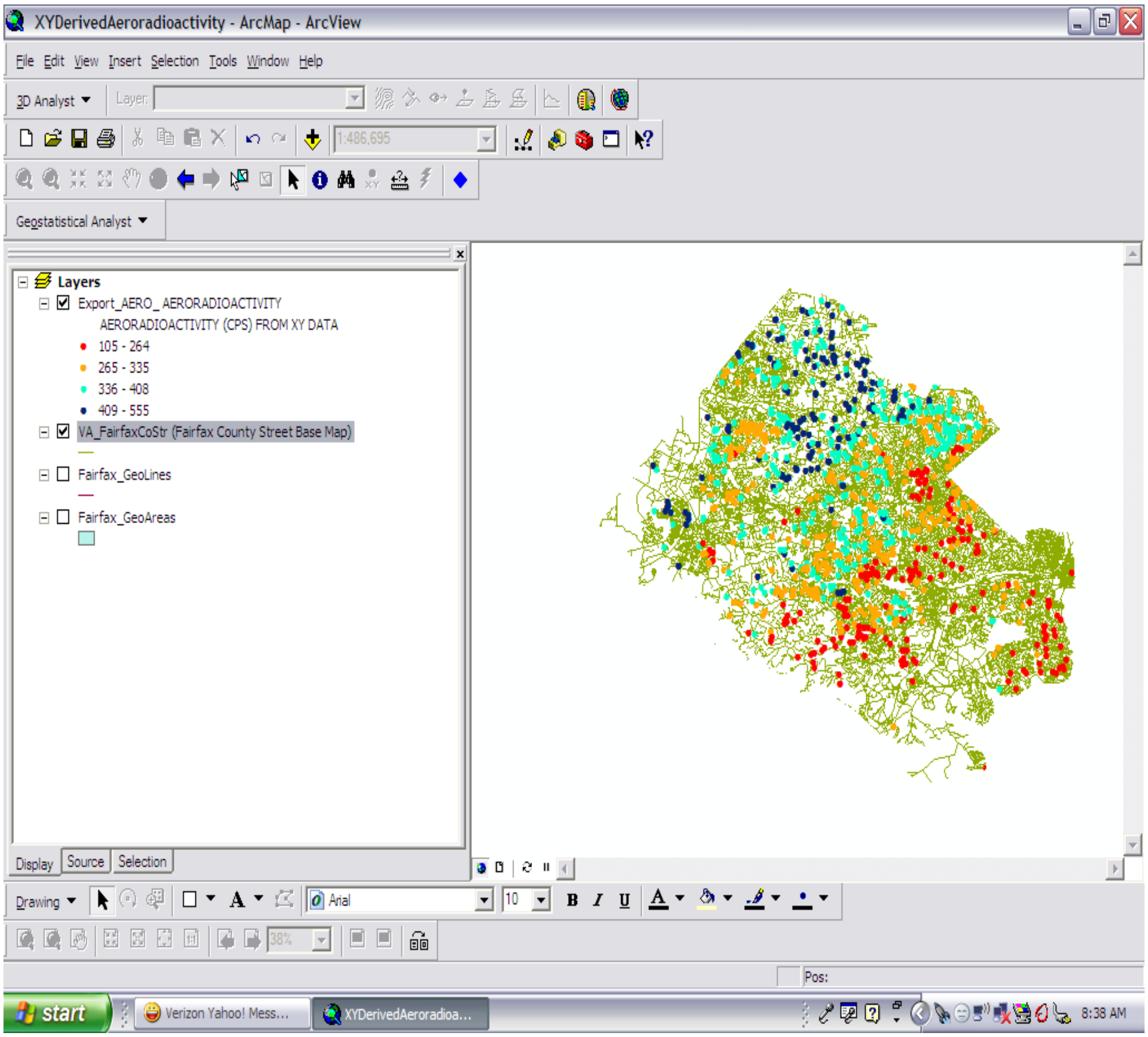


Appendix 8b – 8d

Appendix 8b was generated by importing the aeroradioactivity data into ArcGIS (ArcMap) based on their x,y coordinates and displayed as a map layer. The Aeroradioactivity layer was then spatially joined to the geocoded street addresses of radon homes based on their x,y coordinates and displayed together or separately in ArcGIS (ArcMap). Geocoding (address matching) has the option to generate x,y coordinates along with the geocoded table of street addresses.

Appendix 8c shows the aeroradioactivity data from J. Duval's File that was extracted from the combined geocoded street addresses of radon homes and aeroradioactivity. Appendix 8d shows regression results for the combined seasonal radon and elevation, slope, aeroradioactivity and x,y coordinates (latitude and longitude).

Appendix 8b. Aeroradioactivity at Study Homes in Fairfax County, Virginia



Appendix 8c. Aeroradioactivity Data at Study Homes in Fairfax County, Virginia

No.	X (LONGITUDE)	Y (LATITUDE)	RN (RADON)	AERO (CPS)
1	-77.2265	38.6724	2	331
2	-77.0894	38.7187	1	242
3	-77.0998	38.7051	1	255
4	-77.0915	38.7213	6	217
5	-77.2147	38.7269	1	254
6	-77.2071	38.7123	6	235
7	-77.2161	38.7314	6	243
8	-77.2174	38.7259	5	237
9	-77.2187	38.7287	2	239
10	-77.2147	38.7269	2	254
11	-77.1072	38.7120	2	253
12	-77.1060	38.7187	2	251
13	-77.1027	38.7358	2	195
14	-77.3542	38.7541	2	329
15	-77.1187	38.7410	2	278
16	-77.1223	38.7351	2	299
17	-77.0684	38.7395	2	229
18	-77.0744	38.7203	2	145
19	-77.0692	38.7480	1	251
20	-77.0751	38.7269	2	262
21	-77.0615	38.7195	1	243
22	-77.0689	38.7334	1	238
23	-77.0778	38.7430	1	264
24	-77.0781	38.7345	2	277
25	-77.0582	38.7189	3	238
26	-77.1175	38.7043	3	355
27	-77.0692	38.7480	2	251
28	-77.2136	38.7475	2	234
29	-77.2172	38.7386	2	219
30	-77.2168	38.7388	4	218
31	-77.2137	38.7379	3	227
32	-77.0706	38.7588	2	167
33	-77.2063	38.7297	2	193
34	-77.2043	38.7285	4	212
35	-77.2149	38.7676	4	263

36	-77.2162	38.7697	4	354
37	-77.2322	38.7677	5	307
38	-77.2318	38.7699	4	307
39	-77.2244	38.7706	2	346
40	-77.2107	38.7732	1	366
41	-77.2455	38.7738	2	326
42	-77.2664	38.7596	5	268
43	-77.2444	38.7654	5	337
44	-77.2421	38.7699	4	333
45	-77.2492	38.7654	2	310
46	-77.2490	38.7653	2	312
47	-77.2467	38.7671	1	330
48	-77.2673	38.7616	4	274
49	-77.2478	38.7708	6	305
50	-77.2167	38.7696	7	349
51	-77.2189	38.7648	6	253
52	-77.2478	38.7708	2	305
53	-77.3242	38.7705	4	234
54	-77.3415	38.7775	2	217
55	-77.3777	38.7533	1	190
56	-77.3597	38.7720	1	279
57	-77.3627	38.7687	1	273
58	-77.3713	38.7521	3	338
59	-77.1966	38.7638	6	317
60	-77.1998	38.7744	2	325
61	-77.1998	38.7744	2	325
62	-77.1957	38.7907	2	313
63	-77.1216	38.7930	2	271
64	-77.1345	38.7886	3	263
65	-77.0996	38.7958	3	275
66	-77.0989	38.7933	3	282
67	-77.0573	38.7681	2	248
68	-77.0538	38.7648	2	224
69	-77.4504	38.8118	2	473
70	-77.4504	38.8118	2	473
71	-77.2777	38.7680	2	254
72	-77.2671	38.7987	2	275
73	-77.2740	38.7822	3	238
74	-77.2769	38.7744	4	237
75	-77.2543	38.7998	4	248
76	-77.2637	38.7963	4	286
77	-77.2637	38.7963	2	286

78	-77.2733	38.7826	2	245
79	-77.2429	38.8032	2	263
80	-77.2650	38.7969	2	279
81	-77.2259	38.8077	2	216
82	-77.2536	38.8030	2	247
83	-77.2759	38.7829	2	255
84	-77.2785	38.7734	2	244
85	-77.2743	38.7822	3	237
86	-77.2504	38.8049	3	211
87	-77.2546	38.8112	3	240
88	-77.2611	38.8081	5	278
89	-77.2554	38.8034	5	239
90	-77.2451	38.8151	4	249
91	-77.2451	38.8151	2	249
92	-77.2622	38.8081	2	333
93	-77.2610	38.8081	2	280
94	-77.2536	38.8042	2	229
95	-77.2638	38.7961	2	287
96	-77.2565	38.8013	3	249
97	-77.2459	38.8149	3	249
98	-77.2453	38.8048	4	228
99	-77.2647	38.7987	3	267
100	-77.2604	38.8027	2	227
101	-77.2626	38.7900	2	308
102	-77.2764	38.7825	4	259
103	-77.2537	38.7943	3	274
104	-77.2445	38.8057	3	201
105	-77.2564	38.8049	3	230
106	-77.2672	38.8120	3	382
107	-77.2492	38.8092	4	201
108	-77.2661	38.7954	4	308
109	-77.2604	38.8027	3	227
110	-77.2451	38.8151	2	249
111	-77.2564	38.8049	2	230
112	-77.1563	38.8085	2	156
113	-77.2820	38.7504	4	253
114	-77.2632	38.7597	4	246
115	-77.2011	38.7973	4	265
116	-77.2689	38.7456	2	222
117	-77.2897	38.7471	3	220
118	-77.2584	38.7493	2	217
119	-77.3262	38.7331	1	254

120	-77.1672	38.8121	2	185
121	-77.2983	38.7409	3	247
122	-77.2033	38.7972	2	266
123	-77.2033	38.7972	2	266
124	-77.2037	38.7973	3	257
125	-77.2035	38.7972	2	267
126	-77.2114	38.8082	4	188
127	-77.2625	38.7540	2	195
128	-77.2721	38.7455	2	219
129	-77.2481	38.7562	2	220
130	-77.2540	38.7585	2	228
131	-77.2180	38.7992	1	253
132	-77.2406	38.7552	1	279
133	-77.2100	38.7999	2	235
134	-77.2234	38.7651	2	282
135	-77.2040	38.8079	1	192
136	-77.2566	38.7579	3	215
137	-77.2076	38.8064	3	189
138	-77.2303	38.8052	4	223
139	-77.2004	38.8044	3	211
140	-77.3101	38.7285	2	229
141	-77.2151	38.7789	2	343
142	-77.2164	38.7871	2	325
143	-77.3017	38.7389	2	242
144	-77.2329	38.8018	2	241
145	-77.2511	38.7752	3	271
146	-77.2272	38.7800	1	357
147	-77.2824	38.7545	2	267
148	-77.2026	38.7960	4	267
149	-77.2347	38.7490	2	262
150	-77.2826	38.7611	2	274
151	-77.2036	38.8142	2	241
152	-77.2571	38.7691	4	308
153	-77.2558	38.7494	3	206
154	-77.2081	38.8035	3	206
155	-77.2076	38.8034	4	213
156	-77.2756	38.7580	5	246
157	-77.2303	38.7441	8	243
158	-77.2539	38.7866	4	371
159	-77.2676	38.7695	3	309
160	-77.2321	38.7677	2	309
161	-77.2644	38.7496	2	206

162	-77.2298	38.7753	3	275
163	-77.2578	38.7583	3	216
164	-77.2212	38.7796	1	347
165	-77.2620	38.7729	4	286
166	-77.2259	38.7620	4	309
167	-77.2491	38.7732	5	303
168	-77.2357	38.7767	6	243
169	-77.2836	38.7612	6	275
170	-77.2248	38.7839	5	368
171	-77.2611	38.7511	7	203
172	-77.2815	38.7555	9	269
173	-77.2571	38.7340	8	222
174	-77.2033	38.7972	4	266
175	-77.2467	38.7599	4	296
176	-77.2315	38.7656	4	337
177	-77.2744	38.7681	4	241
178	-77.1888	38.8007	4	239
179	-77.2406	38.7552	3	279
180	-77.2877	38.7420	3	246
181	-77.2824	38.7545	3	267
182	-77.2439	38.7980	3	269
183	-77.1654	38.8130	2	191
184	-77.2831	38.7099	1	223
185	-77.3087	38.7228	1	251
186	-77.2838	38.7172	4	246
187	-77.3089	38.7363	5	213
188	-77.2831	38.7099	3	223
189	-77.3123	38.7345	4	213
190	-77.3061	38.7460	4	249
191	-77.1769	38.8035	6	210
192	-77.1829	38.8201	4	216
193	-77.4011	38.8083	3	292
194	-77.4032	38.8084	2	287
195	-77.3982	38.8050	2	339
196	-77.2273	38.8222	3	295
197	-77.2298	38.8212	3	287
198	-77.1666	38.8275	3	286
199	-77.1772	38.8309	2	253
200	-77.1641	38.8343	2	260
201	-77.1601	38.8310	2	270
202	-77.2998	38.7841	2	359
203	-77.2936	38.7938	2	378

204	-77.2919	38.7912	4	387
205	-77.2912	38.7801	3	355
206	-77.2786	38.7891	3	458
207	-77.2882	38.7793	3	335
208	-77.2784	38.8094	2	398
209	-77.2897	38.7938	2	399
210	-77.3090	38.7860	4	266
211	-77.3534	38.7502	3	208
212	-77.2676	38.8286	3	346
213	-77.2747	38.8087	3	394
214	-77.2834	38.7770	2	197
215	-77.3055	38.7839	1	275
216	-77.3096	38.7851	1	266
217	-77.3076	38.7865	2	274
218	-77.2820	38.7883	3	456
219	-77.3091	38.7851	4	266
220	-77.3376	38.7689	3	207
221	-77.3403	38.7612	3	257
222	-77.3075	38.7883	2	286
223	-77.2736	38.8184	4	325
224	-77.2855	38.8029	4	364
225	-77.3548	38.7468	4	206
226	-77.2807	38.7757	3	227
227	-77.2846	38.7886	3	448
228	0.0000	0.0000	2	372
229	-77.3298	38.7638	1	241
230	-77.3380	38.7627	1	224
231	-77.3380	38.7627	2	224
232	-77.3380	38.7627	3	224
233	-77.3299	38.7639	4	240
234	-77.3392	38.7654	2	200
235	-77.2786	38.7891	2	458
236	-77.2370	38.8166	4	303
237	-77.2567	38.8164	5	336
238	-77.2567	38.8164	3	336
239	-77.2367	38.8143	2	263
240	-77.2338	38.8158	2	268
241	-77.2632	38.8178	2	317
242	-77.2370	38.8166	3	303
243	-77.2567	38.8164	3	336
244	-77.2567	38.8164	4	336
245	-77.1556	38.8340	4	249

246	-77.1556	38.8340	3	249
247	-77.1388	38.8245	4	185
248	-77.1416	38.8231	2	202
249	-77.1493	38.8349	1	219
250	-77.1401	38.8289	1	223
251	-77.0418	38.8059	2	243
252	-77.2072	38.8382	4	339
253	-77.2075	38.8413	3	334
254	-77.1471	38.8431	2	105
255	-77.1313	38.6364	2	112
256	-77.2347	38.8401	2	341
257	-77.2538	38.8402	2	303
258	-77.0608	38.7560	2	168
259	-77.1638	38.7761	3	211
260	-77.0645	38.7790	2	237
261	-77.1073	38.7950	2	246
262	-77.0595	38.7506	2	234
263	-77.0660	38.7816	3	232
264	0.0000	0.0000	3	154
265	-77.0543	38.7230	3	245
266	-77.0703	38.7551	2	150
267	-77.1119	38.7855	2	285
268	-77.0512	38.7248	5	247
269	-77.0966	38.7630	6	293
270	-77.1657	38.7730	2	234
271	-77.1140	38.7757	1	267
272	0.0000	0.0000	2	154
273	-77.0863	38.7803	2	237
274	-77.0690	38.7591	1	161
275	-77.0930	38.7764	1	266
276	-77.0499	38.7216	1	252
277	-77.1128	38.7849	3	272
278	-77.0477	38.7300	3	242
279	-77.1139	38.7949	2	293
280	-77.1237	38.7637	2	336
281	-77.1247	38.7641	5	341
282	-77.1431	38.7745	5	255
283	-77.0823	38.7879	3	256
284	-77.0659	38.7764	3	247
285	-77.0539	38.7418	2	212
286	-77.0680	38.7510	1	225
287	0.0000	0.0000	1	158

288	-77.0660	38.7816	1	232
289	-77.1214	38.8415	1	245
290	-77.1229	38.8429	1	265
291	-77.1486	38.8510	1	276
292	-77.2038	38.8283	1	271
293	-77.1558	38.8420	2	200
294	-77.1697	38.8334	2	236
295	-77.1564	38.8419	3	199
296	-77.1564	38.8419	5	199
297	-77.1429	38.8611	5	304
298	-77.1481	38.8474	3	205
299	-77.1727	38.8470	4	268
300	-77.1338	38.8374	4	218
301	-77.1408	38.8674	2	298
302	-77.2016	38.8268	2	248
303	-77.1497	38.8526	3	291
304	-77.1948	38.8267	2	236
305	-77.1903	38.8432	2	299
306	-77.1734	38.8159	2	259
307	-77.1486	38.8510	2	276
308	-77.1601	38.8439	2	226
309	-77.1569	38.8492	1	247
310	-77.1461	38.8658	2	319
311	-77.1688	38.8532	2	231
312	-77.1640	38.8557	2	248
313	-77.1607	38.8614	2	302
314	-77.1641	38.8521	2	273
315	-77.1525	38.8622	2	267
316	-77.1588	38.8634	2	330
317	-77.1614	38.8670	6	334
318	0.0000	0.0000	4	302
319	-77.3204	38.8463	6	366
320	-77.3105	38.8565	5	389
321	-77.3210	38.8474	3	344
322	-77.3210	38.8474	2	344
323	-77.2418	38.8223	2	322
324	-77.2383	38.8200	3	304
325	-77.2491	38.8267	2	297
326	-77.2367	38.8511	2	406
327	-77.2367	38.8511	4	406
328	-77.2367	38.8510	2	406
329	-77.2396	38.8546	2	391

330	-77.2496	38.8273	2	300
331	-77.2408	38.8576	2	358
332	-77.2346	38.8572	1	384
333	-77.2566	38.8259	1	367
334	-77.2354	38.8208	2	320
335	-77.2351	38.8514	2	403
336	-77.2369	38.8528	4	413
337	-77.2575	38.8296	3	353
338	-77.2408	38.8576	5	358
339	-77.2373	38.8569	6	387
340	-77.2605	38.8303	5	351
341	-77.2340	38.8309	4	369
342	-77.2433	38.8254	1	323
343	-77.2286	38.8321	2	341
344	-77.2281	38.8268	3	326
345	-77.2450	38.8594	3	324
346	-77.2341	38.8307	2	367
347	-77.2156	38.8394	2	370
348	-77.2293	38.8356	2	346
349	-77.2405	38.8315	2	324
350	-77.2440	38.8315	2	310
351	-77.2369	38.8528	3	413
352	-77.2587	38.8284	3	372
353	-77.2497	38.8497	3	347
354	-77.2323	38.8307	2	380
355	-77.2431	38.8254	2	335
356	-77.2514	38.8509	1	340
357	-77.2575	38.8312	2	346
358	-77.2492	38.8349	4	306
359	-77.2304	38.8492	3	359
360	-77.2503	38.8513	3	358
361	-77.2492	38.8478	3	335
362	-77.2430	38.8254	4	330
363	-77.2340	38.8309	4	369
364	-77.2408	38.8576	3	358
365	-77.2598	38.8338	2	325
366	-77.2497	38.8497	1	347
367	-77.2373	38.8569	2	387
368	-77.2514	38.8509	2	340
369	-77.2408	38.8576	2	358
370	-77.2575	38.8312	2	346
371	-77.1586	38.8659	2	336

372	-77.1552	38.8662	2	300
373	-77.4426	38.8470	3	427
374	-77.4426	38.8470	3	427
375	-77.4401	38.8516	4	467
376	-77.4400	38.8516	6	467
377	-77.4250	38.8522	8	350
378	-77.4433	38.8572	3	489
379	-77.4289	38.8290	3	351
380	-77.4248	38.8528	2	348
381	-77.4396	38.8549	7	466
382	-77.4175	38.8225	2	248
383	-77.3408	38.8497	2	240
384	-77.3935	38.8325	2	281
385	-77.4146	38.8154	3	245
386	-77.4191	38.8132	2	295
387	-77.3268	38.8585	2	257
388	-77.4150	38.8232	2	255
389	-77.4190	38.8131	2	295
390	-77.3454	38.8256	2	401
391	-77.3143	38.8698	0	286
392	-77.1905	38.8611	1	285
393	-77.1697	38.8583	4	272
394	-77.1900	38.8714	2	209
395	-77.1952	38.8561	2	302
396	-77.1945	38.8829	2	167
397	-77.1839	38.8484	5	323
398	-77.2127	38.8565	7	316
399	-77.1693	38.8597	10	261
400	-77.1929	38.8856	10	230
401	-77.1875	38.8529	2	306
402	-77.2021	38.8847	2	179
403	-77.1796	38.8516	2	291
404	-77.1765	38.8571	7	316
405	-77.1943	38.8495	8	312
406	-77.1952	38.8483	7	312
407	-77.2006	38.8688	2	234
408	-77.1905	38.8611	2	285
409	-77.1985	38.8538	2	298
410	-77.1685	38.8596	2	248
411	-77.2070	38.8716	2	254
412	-77.2030	38.8710	1	227
413	-77.2002	38.8837	1	175

414	-77.1705	38.8648	1	224
415	-77.2017	38.8431	4	298
416	-77.1732	38.8590	8	271
417	-77.1972	38.8748	7	224
418	-77.1704	38.8565	3	267
419	-77.1884	38.8770	2	187
420	-77.1952	38.8561	1	302
421	-77.1685	38.8596	1	248
422	-77.2572	38.8735	9	335
423	-77.2428	38.8848	2	369
424	-77.2566	38.8722	2	334
425	-77.2566	38.8722	2	334
426	-77.2566	38.8722	2	334
427	-77.3237	38.8100	2	337
428	-77.2701	38.8724	2	316
429	-77.3169	38.8102	7	331
430	-77.2950	38.8280	3	299
431	-77.2923	38.8302	3	284
432	-77.3479	38.7920	3	330
433	-77.2795	38.8424	1	340
434	-77.2572	38.8735	5	335
435	-77.2836	38.8386	5	364
436	-77.2668	38.8700	6	314
437	-77.3689	38.7783	2	268
438	-77.2588	38.8720	2	339
439	-77.3527	38.7889	7	350
440	-77.3170	38.8136	4	400
441	-77.3205	38.8091	3	332
442	-77.3614	38.7886	2	356
443	-77.2904	38.8292	2	282
444	-77.2953	38.8282	1	299
445	-77.2572	38.8735	2	335
446	-77.3169	38.8102	2	331
447	-77.2950	38.8280	2	299
448	-77.3423	38.8888	3	456
449	-77.3423	38.8888	3	456
450	-77.3423	38.8888	2	456
451	-77.3423	38.8899	1	440
452	-77.3423	38.8888	1	456
453	-77.2941	38.8855	5	266
454	-77.2894	38.8875	6	297
455	-77.3110	38.8074	5	379

456	-77.3207	38.8321	5	356
457	-77.3324	38.8085	5	399
458	-77.3867	38.7789	4	325
459	-77.2652	38.8522	5	324
460	-77.3194	38.8316	6	335
461	-77.2969	38.8105	6	298
462	-77.2758	38.8239	1	361
463	-77.2654	38.8988	4	321
464	-77.3052	38.8092	2	323
465	-77.2377	38.8921	2	348
466	-77.2377	38.8921	2	348
467	-77.2377	38.8921	2	348
468	-77.2377	38.8921	3	348
469	-77.2377	38.8921	3	348
470	-77.2914	38.8597	3	443
471	-77.2573	38.8895	3	328
472	-77.2426	38.8934	2	351
473	-77.3324	38.8095	2	414
474	-77.2756	38.8315	2	364
475	-77.2865	38.8162	5	342
476	-77.2566	38.8536	5	297
477	-77.3114	38.8065	5	374
478	-77.2699	38.8470	5	318
479	-77.3114	38.8065	5	374
480	-77.2822	38.8360	5	353
481	-77.2446	38.8714	5	360
482	-77.2781	38.8351	1	385
483	-77.3126	38.8073	3	356
484	-77.2875	38.8196	3	359
485	0.0000	0.0000	5	303
486	-77.2654	38.8507	7	334
487	-77.2790	38.8249	3	383
488	-77.3015	38.8373	2	324
489	-77.3731	38.7904	1	378
490	-77.2769	38.8725	1	343
491	-77.2626	38.8511	2	364
492	-77.2988	38.8383	2	294
493	-77.3001	38.8138	2	279
494	-77.3000	38.8140	5	277
495	-77.3000	38.8140	3	277
496	-77.2960	38.8059	2	312
497	-77.3197	38.7963	3	302

498	-77.2643	38.8873	4	337
499	-77.2569	38.8539	5	298
500	-77.2820	38.8132	5	349
501	-77.2756	38.8315	5	364
502	-77.2756	38.8315	3	364
503	-77.3076	38.8145	2	318
504	-77.2565	38.8485	1	318
505	-77.2566	38.8541	2	302
506	-77.3395	38.7902	4	293
507	-77.2520	38.8642	3	316
508	-77.2976	38.8043	3	325
509	-77.2660	38.8536	6	333
510	-77.3687	38.8022	4	451
511	0.0000	0.0000	2	344
512	-77.3316	38.7906	1	299
513	-77.2366	38.8884	5	360
514	-77.4009	38.7850	2	359
515	-77.2604	38.8523	2	342
516	-77.2979	38.8142	2	296
517	-77.3221	38.7897	3	309
518	-77.3130	38.7866	1	297
519	-77.3444	38.7857	4	264
520	-77.2459	38.8938	4	359
521	-77.2665	38.8536	4	332
522	-77.3066	38.8365	3	317
523	-77.2615	38.8504	3	372
524	-77.3161	38.8074	4	330
525	-77.3117	38.8040	4	357
526	-77.2591	38.8911	7	325
527	-77.3084	38.7911	4	297
528	-77.2879	38.8204	2	331
529	0.0000	0.0000	4	364
530	-77.2943	38.8088	4	302
531	-77.3114	38.7900	4	311
532	-77.2651	38.8409	3	353
533	-77.3060	38.8009	2	366
534	-77.2639	38.8594	2	365
535	-77.2989	38.8133	3	285
536	-77.2613	38.8548	3	349
537	-77.3147	38.7879	8	301
538	-77.2959	38.8062	5	312
539	-77.2622	38.8436	3	360

540	-77.2492	38.8624	4	309
541	-77.3058	38.8199	6	271
542	-77.2666	38.8575	6	387
543	-77.3175	38.7920	2	318
544	-77.3183	38.7914	3	317
545	-77.2996	38.7935	3	369
546	-77.2682	38.8962	3	338
547	-77.3050	38.8105	1	319
548	-77.3201	38.8418	1	411
549	-77.3101	38.8057	1	395
550	-77.3319	38.7854	3	269
551	-77.3314	38.7858	3	269
552	-77.2881	38.8489	7	331
553	-77.3166	38.8306	7	300
554	-77.3075	38.8211	7	280
555	-77.2796	38.8714	6	336
556	-77.3745	38.7811	5	352
557	-77.2884	38.8200	3	335
558	-77.2828	38.8201	2	322
559	-77.3023	38.8221	3	280
560	-77.2992	38.8212	5	298
561	-77.2569	38.8539	7	297
562	-77.3443	38.7878	4	298
563	-77.3013	38.8363	3	308
564	-77.3494	38.7885	4	296
565	-77.2632	38.8538	3	346
566	-77.2904	38.8279	3	291
567	-77.2766	38.8231	7	363
568	-77.3922	38.7795	9	330
569	-77.3923	38.7796	9	330
570	-77.3201	38.8419	8	408
571	-77.2833	38.8125	2	357
572	-77.2974	38.8208	5	307
573	-77.3535	38.8075	3	329
574	-77.3337	38.8140	3	358
575	-77.3975	38.7684	1	271
576	-77.3859	38.7785	3	311
577	-77.3652	38.7933	5	392
578	-77.3197	38.7963	7	302
579	-77.3294	38.8015	5	268
580	-77.3104	38.7903	3	324
581	-77.2566	38.8536	5	297

582	-77.2756	38.8315	6	364
583	-77.2959	38.8062	9	312
584	-77.2565	38.8485	10	318
585	-77.2992	38.8212	9	298
586	-77.3427	38.7862	6	289
587	-77.3316	38.7906	4	299
588	-77.3050	38.8105	3	319
589	-77.2881	38.8489	3	331
590	-77.4248	38.8781	2	330
591	-77.4248	38.8781	3	333
592	-77.4740	38.8952	6	372
593	-77.4172	38.8703	5	360
594	-77.4254	38.8222	7	284
595	-77.4126	38.8619	8	306
596	-77.4165	38.8731	8	329
597	-77.4142	38.8610	7	316
598	-77.4772	38.8984	1	427
599	-77.4655	38.8278	1	351
600	-77.4168	38.8729	3	326
601	-77.4253	38.8311	3	260
602	-77.4248	38.8781	3	330
603	-77.1771	38.9128	3	392
604	-77.2457	38.9132	2	314
605	-77.2388	38.9078	2	256
606	-77.2334	38.9027	3	277
607	-77.2336	38.9027	3	276
608	-77.2329	38.9026	1	278
609	-77.2427	38.9098	5	267
610	-77.2427	38.9098	5	267
611	-77.1737	38.9299	5	353
612	-77.1735	38.9266	7	353
613	-77.1735	38.9266	10	353
614	-77.2801	38.6854	5	427
615	-77.3261	38.9305	3	492
616	-77.3377	38.9027	6	424
617	-77.2800	38.6854	7	427
618	-77.3379	38.9057	4	386
619	-77.3272	38.9220	3	429
620	-77.2801	38.6854	4	427
621	-77.3145	38.9252	6	415
622	-77.3724	38.9295	2	277
623	-77.3721	38.9334	2	287

624	-77.3388	38.9643	3	425
625	-77.3388	38.9643	2	428
626	-77.3371	38.9624	2	457
627	-77.1642	38.9402	3	338
628	-77.1650	38.9294	3	387
629	-77.1812	38.9478	2	405
630	-77.1670	38.9284	1	366
631	-77.1658	38.9020	1	303
632	-77.1658	38.9020	1	303
633	-77.1673	38.9288	5	376
634	-77.1812	38.9266	5	355
635	-77.1525	38.9175	2	338
636	-77.1624	38.8738	1	314
637	-77.1643	38.9470	2	270
638	-77.1679	38.9269	4	373
639	-77.1599	38.8777	3	289
640	-77.1793	38.9294	3	302
641	-77.1846	38.9077	3	405
642	-77.1788	38.9480	3	388
643	-77.1778	38.9461	3	357
644	-77.1741	38.9171	3	389
645	-77.1765	38.9202	3	390
646	-77.2058	38.8913	3	200
647	-77.2043	38.8915	2	218
648	-77.1900	38.9374	1	321
649	-77.1900	38.9374	2	325
650	-77.1894	38.9554	2	421
651	-77.2087	38.8908	4	253
652	-77.1519	38.9144	4	280
653	-77.1720	38.8966	4	302
654	-77.1665	38.8691	4	233
655	-77.1646	38.8750	2	298
656	-77.1551	38.9311	2	397
657	-77.1559	38.9303	2	371
658	-77.1809	38.9227	3	395
659	-77.1563	38.9120	6	244
660	-77.1637	38.9317	4	395
661	-77.1890	38.9181	2	330
662	-77.1570	38.9219	2	360
663	-77.1701	38.9423	3	367
664	-77.1777	38.9483	5	398
665	-77.1690	38.9252	5	382

666	-77.1480	38.9260	4	389
667	-77.1508	38.8934	3	264
668	-77.1885	38.9319	2	357
669	-77.1864	38.9445	2	367
670	-77.1383	38.9285	2	333
671	-77.1686	38.8973	2	290
672	-77.2149	38.8841	2	329
673	-77.1381	38.9252	2	301
674	-77.1414	38.9223	2	314
675	-77.1696	38.9308	3	374
676	-77.1608	38.8849	5	383
677	-77.1873	38.9174	6	328
678	-77.1819	38.9432	5	372
679	-77.1825	38.9325	2	321
680	-77.1315	38.9361	2	312
681	-77.1859	38.8889	3	281
682	-77.1663	38.9054	3	298
683	-77.1906	38.9111	3	374
684	-77.1610	38.9130	4	259
685	-77.1918	38.9215	4	334
686	-77.1851	38.9187	3	328
687	-77.1644	38.9101	3	225
688	-77.1811	38.9401	2	307
689	-77.1678	38.9237	2	370
690	-77.1658	38.9020	2	303
691	-77.1409	38.9337	2	344
692	-77.1600	38.9131	3	253
693	-77.1697	38.9307	2	374
694	-77.1662	38.9191	3	340
695	-77.1547	38.9321	2	399
696	-77.1742	38.9338	2	337
697	-77.1824	38.9106	2	369
698	-77.1703	38.9309	2	369
699	-77.1719	38.9155	3	390
700	-77.1895	38.9522	3	416
701	-77.1723	38.9138	3	352
702	-77.1691	38.9517	2	353
703	-77.1687	38.9542	4	353
704	-77.1929	38.8948	3	225
705	-77.2010	38.8940	3	233
706	-77.1655	38.9606	4	293
707	-77.1978	38.8884	3	209

708	-77.1653	38.8836	3	288
709	-77.1622	38.9042	2	265
710	-77.1392	38.9317	2	348
711	-77.1678	38.9545	2	352
712	-77.1471	38.9406	2	362
713	-77.1486	38.9415	2	364
714	-77.1889	38.9495	1	397
715	-77.1693	38.9199	2	368
716	-77.1871	38.9146	1	359
717	-77.1924	38.8941	1	234
718	-77.1619	38.9233	2	340
719	-77.1706	38.8820	1	236
720	-77.1890	38.9181	6	330
721	-77.1591	38.9220	1	335
722	-77.1498	38.9143	2	283
723	-77.1482	38.9205	2	341
724	-77.1693	38.9482	3	336
725	-77.1612	38.9382	3	395
726	-77.1973	38.8908	3	207
727	-77.1591	38.9220	3	335
728	-77.1978	38.8884	3	209
729	-77.1655	38.9606	3	293
730	-77.4592	38.8575	5	449
731	-77.4616	38.8619	3	488
732	-77.4762	38.8593	4	356
733	-77.4648	38.8591	4	479
734	-77.4613	38.8630	3	480
735	-77.4566	38.8470	2	402
736	-77.4618	38.8674	1	504
737	-77.4617	38.8621	2	503
738	-77.4617	38.8621	2	503
739	-77.2095	38.9540	2	388
740	-77.2053	38.9462	2	357
741	-77.2063	38.9666	1	319
742	-77.2131	38.9366	1	368
743	-77.2152	38.9379	2	394
744	-77.2078	38.9493	3	410
745	-77.4133	38.9283	2	364
746	-77.3957	38.9085	2	278
747	-77.4152	38.9075	2	394
748	-77.3937	38.8676	2	316
749	-77.4172	38.8873	2	329

750	-77.4006	38.9191	3	363
751	-77.3982	38.9322	6	471
752	-77.3975	38.9075	6	274
753	-77.3843	38.9292	5	316
754	-77.4109	38.8829	3	367
755	-77.4109	38.8829	1	367
756	-77.4130	38.9153	3	392
757	-77.4002	38.9098	4	315
758	-77.3817	38.9331	3	279
759	-77.3980	38.9287	3	498
760	-77.3979	38.9042	3	354
761	-77.4015	38.9038	4	386
762	-77.3899	38.9119	6	331
763	-77.4004	38.9059	5	368
764	-77.3846	38.9337	6	300
765	-77.3993	38.8696	6	298
766	-77.4018	38.9209	2	371
767	-77.3993	38.9292	2	447
768	-77.4005	38.9192	5	364
769	-77.4090	38.9033	6	402
770	-77.4089	38.9031	5	402
771	-77.4139	38.9030	4	400
772	-77.4099	38.8826	3	374
773	-77.3922	38.9356	3	374
774	-77.3936	38.8747	2	267
775	-77.3937	38.8749	2	269
776	-77.3906	38.8748	3	318
777	-77.4101	38.9033	3	399
778	-77.3988	38.9218	3	350
779	-77.4105	38.9046	1	402
780	-77.4099	38.8826	1	374
781	-77.4105	38.9046	1	402
782	-77.4193	38.8220	3	253
783	-77.3965	38.8705	2	295
784	-77.4261	38.8880	2	468
785	-77.4035	38.9216	2	370
786	-77.3959	38.9149	4	298
787	-77.3993	38.8696	4	298
788	-77.4213	38.8224	5	283
789	-77.3981	38.9124	5	290
790	-77.3893	38.9271	5	333
791	-77.3800	38.9330	6	271

792	-77.3967	38.9042	9	320
793	-77.4031	38.8938	7	338
794	-77.3825	38.9354	5	284
795	-77.3917	38.9089	4	260
796	-77.4127	38.9034	3	399
797	-77.3989	38.8712	3	303
798	-77.3999	38.8741	3	272
799	-77.4185	38.8254	3	252
800	-77.4207	38.9402	3	416
801	-77.3819	38.9290	4	283
802	-77.4107	38.9299	5	370
803	-77.4183	38.9123	4	392
804	-77.3957	38.9085	2	278
805	-77.3846	38.9337	5	300
806	-77.4183	38.9123	4	392
807	-77.2255	38.9618	3	468
808	-77.2255	38.9618	3	468
809	-77.2427	38.9686	3	431
810	-77.2434	38.9688	3	430
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812	-77.2755	38.9768	2	421
813	-77.2763	38.9819	5	408
814	-77.4031	38.9796	3	329
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816	-77.4063	38.9764	5	348
817	-77.3889	38.9957	8	436
818	-77.3964	38.9845	6	357
819	-77.3964	38.9845	5	357
820	-77.3895	38.9704	5	293
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822	-77.3856	38.9880	3	385
823	-77.3882	38.9931	3	421
824	-77.4041	38.9763	3	328
825	-77.3736	38.9758	3	331
826	-77.3759	38.9332	3	289
827	-77.3687	38.9803	4	342
828	-77.3754	38.9336	2	278
829	-77.3736	38.9758	3	331
830	-77.3630	38.9741	2	336
831	-77.3725	39.0007	3	403
832	-77.3741	39.0021	3	421
833	-77.3788	39.0037	5	413

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836	-77.3011	38.9406	7	392
837	-77.3088	39.0152	7	374
838	-77.2963	38.8898	6	328
839	-77.2733	38.9464	5	427
840	-77.3355	38.8345	2	406
841	-77.2561	38.8983	3	358
842	-77.3505	38.9845	2	438
843	-77.2637	38.8959	5	378
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845	-77.3085	38.9603	2	435
846	-77.2981	38.8897	2	333
847	-77.3465	38.9848	3	362
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849	-77.3124	38.8494	3	361
850	-77.2524	38.9479	2	425
851	-77.2520	38.9480	4	425
852	-77.2391	38.9619	5	401
853	-77.3285	38.8963	2	457
854	-77.2343	38.8835	6	339
855	-77.3075	38.9850	2	380
856	-77.3075	38.9846	2	380
857	-77.2711	38.9147	1	342
858	-77.3536	38.8364	1	332
859	-77.2676	38.9215	3	367
860	-77.3361	38.9208	5	384
861	-77.3474	39.0070	6	428
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863	-77.3247	38.9367	3	474
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871	-77.2569	38.9642	2	453
872	-77.2895	38.9915	2	519
873	-77.2895	38.9914	4	519
874	-77.2887	38.8845	4	271
875	-77.3136	38.9055	2	424

876	-77.2168	38.9398	2	411
877	-77.2854	38.9748	3	438
878	-77.3404	38.9375	3	383
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880	-77.2650	38.9864	2	474
881	-77.2650	38.9865	5	474
882	-77.2915	38.9188	2	353
883	-77.3210	38.9382	2	433
884	-77.3374	38.9371	3	355
885	-77.3467	38.9845	3	362
886	-77.3203	38.9389	2	430
887	-77.3660	38.9281	2	291
888	-77.3483	38.9840	5	376
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892	-77.2343	38.9035	4	271
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896	-77.3460	38.9423	4	370
897	-77.2737	38.9477	3	458
898	-77.3515	38.9296	3	328
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901	-77.3503	38.9863	5	375
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903	-77.3509	38.9848	4	428
904	-77.3034	38.9103	2	325
905	-77.3859	38.8702	2	346
906	-77.3537	38.9280	4	333
907	-77.3405	38.9376	4	384
908	-77.2923	39.0005	4	476
909	-77.2913	38.9999	3	476
910	-77.2494	38.9237	3	349
911	-77.3473	38.9868	2	372
912	-77.3060	39.0001	2	388
913	-77.2102	38.9416	3	324
914	-77.3530	38.8977	6	394
915	-77.1954	38.9275	2	323
916	-77.3832	38.8390	2	338
917	-77.2413	38.9034	2	355

918	-77.1954	38.9275	2	323
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920	-77.2002	38.9363	6	286
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924	-77.3060	38.9165	5	421
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926	-77.1987	38.9361	4	284
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928	-77.3644	38.9253	4	305
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930	-77.3113	38.9427	6	440
931	-77.3097	38.9843	3	415
932	-77.2770	38.9516	3	495
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934	-77.3630	38.9117	4	294
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939	-77.2838	38.9208	2	443
940	-77.2984	38.8909	3	365
941	-77.3344	38.9338	4	407
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943	-77.3062	38.8964	2	463
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955	-77.3167	38.9895	10	554
956	-77.2844	38.9088	8	369
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993	-77.2801	38.8873	2	318
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1007	-77.3213	38.9261	3	449
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1139	-77.3259	39.0023	1	392
1140	-77.2610	38.9693	4	453
1141	-77.2473	38.9485	3	399
1142	-77.3431	39.0077	4	418
1143	-77.2733	38.9464	7	427
1144	-77.2915	38.9188	2	353
1145	-77.3346	38.9259	4	403
1146	-77.3011	38.9406	3	392
1147	-77.3606	38.9194	6	298
1148	-77.3274	38.9306	2	444
1149	-77.2114	38.9445	2	371
1150	-77.2939	38.9264	3	367
1151	-77.3210	38.9382	3	433
1152	-77.3467	38.9845	2	362
1153	-77.2737	38.9477	4	458
1154	-77.3361	38.9208	3	384
1155	-77.2943	38.9018	3	422
1156	0.0000	0.0000	3	448
1157	0.0000	0.0000	3	366
1158	-77.2002	38.9363	2	286
1159	-77.2918	38.8910	1	323
1160	-77.2468	38.9246	2	322
1161	-77.3420	38.9378	3	377
1162	-77.3091	38.9382	3	415
1163	-77.3479	38.8908	4	389
1164	-77.2366	38.9388	4	382
1165	-77.3832	38.8390	5	338
1166	-77.3283	38.8951	3	455
1167	-77.3493	39.0247	2	420
1168	-77.3878	38.9115	3	336
1169	-77.3787	38.9261	4	301

1170	-77.3878	38.9117	4	325
1171	-77.3787	38.9274	3	300
1172	-77.3789	38.9276	2	311
1173	-77.3602	38.9737	5	341
1174	-77.3780	38.9187	2	293
1175	-77.3793	38.9272	3	283
1176	-77.3604	38.9737	4	342
1177	-77.3735	38.8820	4	287
1178	-77.3493	39.0247	3	420
1179	-77.3910	38.8652	3	333
1180	-77.3793	38.9269	4	285
1181	-77.3878	38.9115	2	333
1182	-77.3851	38.9128	2	278
1183	-77.3493	39.0247	3	420
1184	-77.3493	39.0247	3	420
1185	-77.3493	39.0247	3	420
1186	-77.3851	38.9128	3	278
1187	-77.2907	39.0278	2	460
1188	-77.3133	39.0309	2	397
1189	-77.3071	39.0217	3	375
1190	-77.3071	39.0221	4	381
1191	-77.2958	39.0376	5	428
1192	-77.3036	39.0147	4	412
1193	-77.3221	39.0322	3	441
1194	-77.3162	39.0305	3	422
1195	-77.2732	39.0223	3	417
1196	-77.3133	39.0309	3	397
1197	-77.3571	39.0111	4	457
1198	-77.3561	38.9908	2	411
1199	-77.3024	39.0410	2	403
1200	-77.2081	38.9684	2	313
1201	-77.2081	38.9684	3	313
1202	-77.1841	38.9663	3	354
1203	-77.1358	38.9485	5	267
1204	-77.2803	39.0351	5	362
1205	-77.2081	38.9684	4	313

Source: Mose, D.G. (2005). Personal Communication, Joseph Duval, USGS.

Appendix 8d. Regression Results for Combined Seasonal Indoor Radon, Aeroradioactivity, Slope, Elevation and X,Y Coordinates at Study Homes in Fairfax County, Virginia

Regression Results

1. **WITERAD regressed on ELEV_FT, SLOPE, LAT_LONG with a constant term included.**

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	LAT_ LONG, SLOPE, ELEV_FT[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: WINTERRAD

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.123[a]	.015	.013	4.002	1.868

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: WINTERRAD

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	397.642	3	132.547	8.277	.000[a]
	Residual	25861.273	1615	16.013		
	Total	26258.915	1618			

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: WINTERRAD

Coefficients[a]

Model		Unstandardized Coefficient		Standardized Coefficient	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.436	.195		17.621	.000
	ELEV_FT	-.002	.001	-.091	-2.883	.004
	SLOPE	-.028	.051	-.017	-.548	.583
	LAT_LONG	.019	.005	.092	3.635	.000

a. Dependent Variable: WINTERRAD

Regression Results Continued…

2. **SPRINGRAD regressed on same set of variables as in #1 above.**

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	LAT_ LONG, SLOPE, ELEV_FT[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: SPRINGRAD

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.116[a]	.013	.012	3.763	1.845

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: SPRINGRAD

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	310.534	3	103.511	7.311	.000[a]
	Residual	22866.465	1615	14.159		
	Total	23176.999	1618			

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: SPRINGRAD

Coefficients[a]

Model		Unstandardized Coefficient B	Unstandardized Coefficient Std. Error	Standardized Coefficient Beta	t	Sig.
1	(Constant)	2.786	.183		15.196	.000
	ELEV_FT	-.001	.001	-.051	-1.605	.109
	SLOPE	-.053	.048	-.034	-1.089	.276
	LAT_LONG	.020	.005	.104	4.114	.000

a. Dependent Variable: SPRINGRAD

Regression Results Continued…

3. FALLRAD regressed on same set of variables as in #1 above.

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	LAT_ LONG, SLOPE, ELEV_FT[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: FAL_RAD

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.018[a]	.000	-.002	3.971	1.720

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: FAL_RAD

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.359	3	2.786	.177	.912[a]
	Residual	25470.478	1615	15.771		
	Total	25478.838	1618			

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: FAL_RAD

Coefficients[a]

Model		Unstandardized Coefficient		Standardized Coefficient	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.216	.194		16.619	.000
	ELEV_FT	.000	.001	.007	-.215	.830
	SLOPE	-.016	.051	-.010	-.321	.748
	LAT_LONG	.003	.005	.013	.516	.606

a. Dependent Variable: FAL_RAD

4. SUMMERRAD regressed on ELEV_FT, SLOPE, LAT_LONG with a constant term included.

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	LAT_ LONG, SLOPE, ELEV_FT[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: SUMMERRAD

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.101[a]	.010	.008	2.582	1.692

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: SUMMERRAD

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	111.819	3	37.273	5.590	.001[a]
	Residual	10769.020	1615	6.668		
	Total	10880.839	1618			

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: SUMMERRAD

Coefficients[a]

Model		Unstandardized Coefficient		Standardized Coefficient	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.462	.126		19.563	.000
	ELEV_FT	-.001	.001	-.069	-2.169	.030
	SLOPE	.005	.033	.005	.161	.872
	LAT_LONG	.012	.003	.091	3.592	.000

a. Dependent Variable: SUMMERRAD

5. MEANRAD regressed on ELEV_FT, SLOPE, LAT_LONG with a constant term included.

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	LAT_ LONG, SLOPE, ELEV_FT[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: Mean Radon

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.105[a]	.011	.009	2.95047	1.805

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: Mean Radon

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	157.383	3	52.461	6.026	.000[a]
	Residual	14059.029	1615	8.705		
	Total	14216.412	1618			

a. Predictors: (Constant), LAT_LONG, SLOPE, ELEV_FT
b. Dependent Variable: Mean Radon

Coefficients[a]

Model		Unstandardized Coefficient B	Unstandardized Coefficient Std. Error	Standardized Coefficient Beta	t	Sig.
1	(Constant)	2.975	.144		20.692	.000
	ELEV_FT	-.001	.001	-.065	-2.036	.042
	SLOPE	-.023	.038	-.019	-.606	.544
	LAT_LONG	.013	.004	.089	3.504	.000

a. Dependent Variable: Mean Radon

Data Table Revised to Include TCGAMMAURA (limited number of observations)

6. WINTERRAD regressed on ELEV_FT, SLOPE, LAT_LONG, TCGAMMAURA with a constant term included.

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: WINTERRAD

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.289[a]	.083	.055	4.794	2.406

a. Predictors: (Constant), TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG
b. Dependent Variable: WINTERRAD

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	271.889	4	67.972	2.957	.022[a]
	Residual	2987.845	130	22.983		
	Total	3259.733	134			

a. Predictors: (Constant), TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG
b. Dependent Variable: WINTERRAD

Coefficients[a]

Model		Unstandardized Coefficient		Standardized Coefficient	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.097	4.448		.471	.638
	LAT_LONG	-.125	.044	-.243	-2.847	.005
	ELEV_FT	.001	.005	.011	.126	.900
	SLOPE	.142	.175	.069	.811	.419
	TCGAMMAURA	.021	.012	.154	1.808	.073

a. Dependent Variable: WINTERRAD

7. SPRINGRAD regressed on ELEV_FT, SLOPE, LAT_LONG, TCGAMMAURA with a constant term included.

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: SPRINGRAD

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.230[a]	.053	.024	4.139	2.213

a. Predictors: (Constant), TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG
b. Dependent Variable: SPRINGRAD

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	124.272	4	31.068	1.813	.130[a]
	Residual	2227.387	130	17.134		
	Total	2351.659	134			

a. Predictors: (Constant), TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG
b. Dependent Variable: SPRINGRAD

Coefficients[a]

Model		Unstandardized Coefficient		Standardized Coefficient		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.575	3.840		.410	.682
	LAT_LONG	-.066	.038	-.151	-1.735	.085
	ELEV_FT	.003	.004	.064	.737	.462
	SLOPE	.240	.151	.137	1.582	.116
	TCGAMMAURA	.009	.010	.076	.879	.381

a. Dependent Variable: SPRINGRAD

8. SUMMERRAD regressed on ELEV_FT, SLOPE, LAT_LONG, TCGAMMAURA with a constant term included.

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG[a]	.	ENTER

a. All requested variables entered.
b. Dependent Variable: SUMMERRAD

Model Summary[b]

Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.213[a]	.045	.016	1.634	1.926

a. Predictors: (Constant), TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG
b. Dependent Variable: SUMMERRAD

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.451	4	4.113	1.540	.195[a]
	Residual	347.282	130	2.671		
	Total	363.733	134			

a. Predictors: (Constant), TCGAMMAURA, ELEV_FT, SLOPE, LAT_LONG
b. Dependent Variable: SUMMERRAD

Coefficients[a]

Model		Unstandardized Coefficient		Standardized Coefficient	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.424	1.516		2.918	.004
	LAT_LONG	-.035	.015	-.204	-2.340	.021
	ELEV_FT	-.001	.002	-.038	-.442	.660
	SLOPE	.025	.060	.036	.415	.679
	TCGAMMAURA	-.002	.004	-.039	-.451	.653

a. Dependent Variable: SUMMERRAD

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Curriculum Vitae

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