SURVEY PLAN

Final Status Survey

Of

2 Morgan Drive Lot A

Mt. Kisco, NY

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1.0 INTRODUCTION

Radioactive contamination has been detected on the property of the former Mt. Kisco Wastewater Treatment Plant (WWTP) located on Morgan Drive in Mt. Kisco, NY. From 1913 until 1964, the WWTP received sewage from the Village of Mt. Kisco including the Canadian Uranium and Radium Corporation facility located about 3 miles north of the plant. This led to elevated concentrations of radium-226 and thorium-230 being deposited in numerous spots across the property. To study the problem, in 2019, the New York City Department of Environmental Protection and CoPhysics Corp. performed gamma radiation measurements over the entire property.

The results of the 2019 surface radiation survey showed that the parcel known as 2 Morgan Drive, Lot A had no detectable radioactive contamination. Therefore, the objective of this survey is to perform a final status survey (FSS) of Lot A so that it can be released from radiological safety controls and be developed. The final status survey extends the original surface survey by performing additional readings, collecting and analyzing sub-surface soil samples, and performing a more in-depth statistical analysis to prove that the lot is free of any residual radioactive contamination. The radiation measurements and the analysis of results for this FSS will be performed per the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

2.0 BACKGROUND

2.1 Site Location

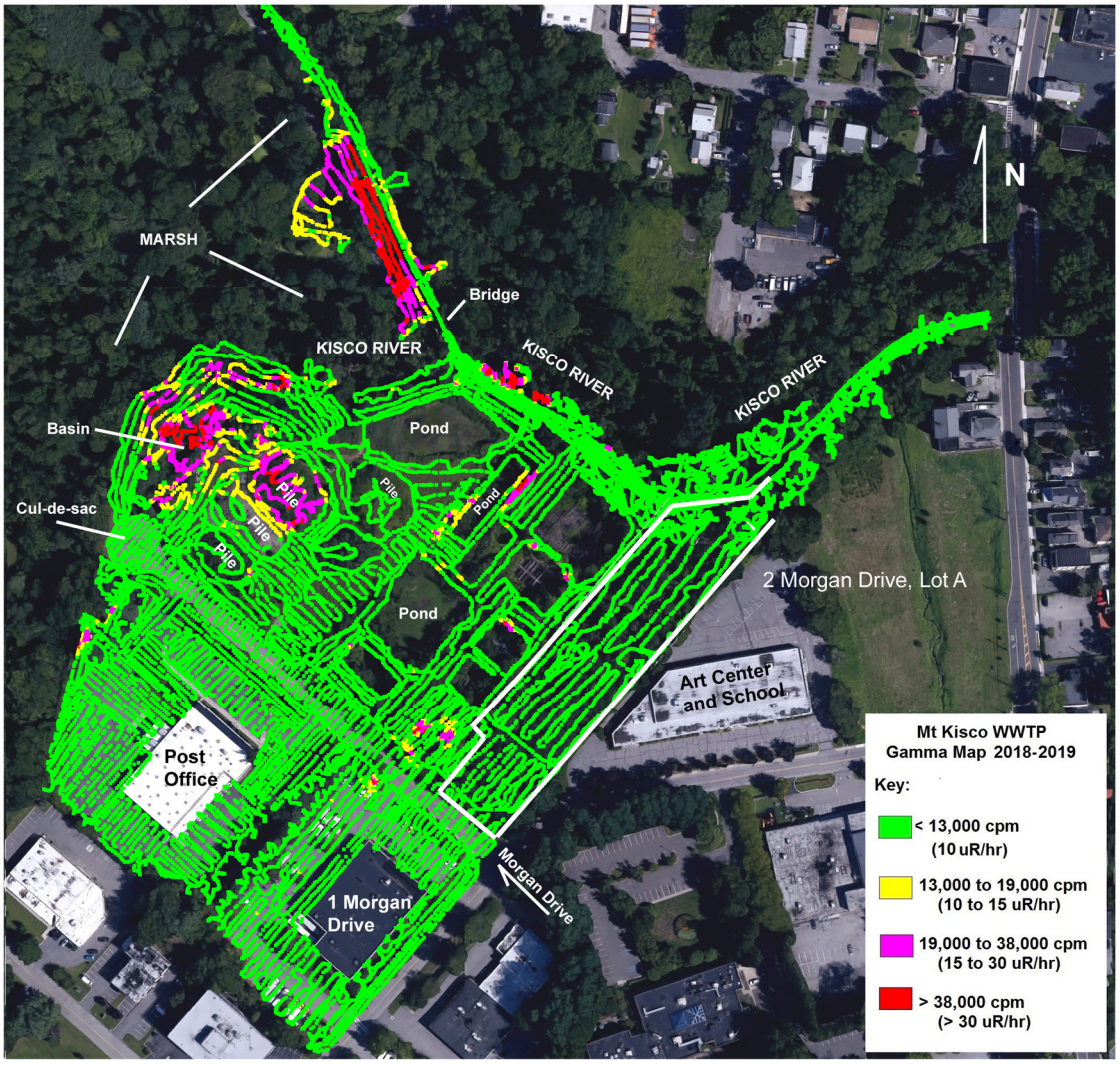
Lot A of 2 Morgan Drive comprises 2.67 acres and lays on the southern-most boundary of the WWTP site. The lot has no vehicle access and is heavily wooded with many large 100+ year-old trees further indicating that sewage sludge had not been deposited there in any large quantity.

The gamma map of the FWWTP with Lot A outlined in white is shown in Figure 3-1.

2.2 Expected Radiation Levels

Scoping gamma radiation measurements performed in 2019 show normal background radiation levels (8 to 10 uR/hr at the surface).

Figure 2-1 – Gamma Map of FWWTP Site (2 Morgan Drive Lot A Shown in White)



3.0 REGULATORY REQUIREMENTS AND GUIDELINES

While the NYSDEC has not specified an exact cleanup goal for the FWWTP site, a radium-226 concentration limit of 5 pCi/g and thorium-230 limit of 60 pCi/g is proposed here. (The WWTP Characterization Survey Report (August, 2019) indicated that Th-230 levels were approximately 12 times the radium-226 levels.) 5 pCi/g of Ra-226 is a typical Derived Concentration Guideline Level (DCGL) used by the USEPA at its Superfund cleanup sites in Region 2 (NY and NJ).

As proof that the above proposed DCGL's are protective of health, a RESRAD analysis was performed (see results in Appendix A). The radiation dose to future occupants living on soil containing 5 pCi/g Ra-226 and 60 pCi/g Th-230 was calculated. The results show a total radiation dose from all pathways of 14.2 mrem/yr (This occurred at the 300-year mark and assumed the entire property had radionuclide levels at the DCGL.) This is within the regulatory prescribed dose limits for decommissioned sites of 15 mrem/yr (USEPA) and 25 mrem/yr (USNRC). Further conservatism would occur when calculating actual doses considering that only a small fraction of the property would experience levels at the DCGL if any.

To translate the radium DCGL into gamma count rates from a Ludlum 44-10 detector, a guideline limit of 13,000 cpm is proposed for this survey. Per the WWTP Characterization Survey Report (August, 2019), gamma count rates less than 13,000 cpm are indicative of soil containing less than 5 pCi/g of radium-226.

4.0 METHODOLOGY

All instruments will be calibrated with 1 year of use and shall be background- and source-check daily when in use.

4.1 Gamma Scan

The scan previously performed and as supplemented in this survey is performed by collection of 1-second gamma counts using a Ludlum 44-10 (2x2-inch) scintillation detector coupled to a Model 2221 ratemeter and GPS-based localization and recording system. The supplemental scanning measurements will be performed to fill-in data gaps in the previously-collected scan results.

4.2 Systematic Gamma Readings

One-minute gamma radiation counts using a Ludlum 44-10 (2x2-inch) scintillation detector coupled to a Model 2221 ratemeter will be performed at each grid point shown in Appendix B.

The grid was developed by taking 60 previously obtained readings and analyzing them per

MARSSIM Chapter 5. The result of the "N" analysis was that a minimum of 9 points would be needed. Per the surveyor's judgement, 22 points will be collected per the grid layout in Appendix B.

Background Area

Al least 9 points will be collected in a background (reference) area for comparison to the data collected in the survey area.

4.3 Downhole Gamma Logging

Boreholes will be installed into the ground at 5 selected locations using a 1.5-inch diameter steel punch. Boreholes will be lined with a 1.25-inch PVC sleeve and surveyed in 6-inch depth increments using a Ludlum 44-62 (1/2x3/4-inch) scintillation detector coupled to a Model 2221 ratemeter. The detector count rates will be recorded to provide a depth profile of radioactivity. After the gamma profile of each hole is obtained, a hand auger will be used directly adjacent to the borehole to collect a soil sample from the depth of maximum count rate.

The soil samples will be sent to Pace Laboratories for radium-226 and isotopic thorium analysis.

4.4 Work Tasks

The survey duration is expected to be one (1) day. The work tasks follow:

1. Supplement the surface gamma survey of the area conducted in 2019 by scanning portions of the lot not scanned in 2019, especially under the pile of logs present. Readings under the log pile will be performed using the gamma detector attached to a long pole.
2. Perform systematic gamma readings (1-minute counts) on a grid of the survey area per MARSSIM. (See grid layout in Appendix B).
3. Perform systematic gamma readings (1-minute counts) on a grid of a background area (if available).
4. Punch 5 boreholes (5 feet deep) along the boundary of the Lot nearest the contamination on the adjoining Lot B. These boreholes will be gamma-logged using a Ludlum 44-62 detector. (See borehole layout in Appendix C).
5. At the depth of maximum count rate in each borehole, a soil sample will be collected via hand auguring. The 5 soil samples collected will be analyzed at Pace Laboratories for Ra-226 and isotopic thorium. These 5 samples are considered to be biased samples to prove that there is no subsurface migration of contamination from the adjoining lot.

5.0 DATA ANALYSIS AND REPORT

The results of the surface gamma scan will be plotted on an aerial photo of the property using color-coded markers.

The systematic surface gamma counts will be analyzed using the MARSSIM WRS test to determine if the results are statistically significant to prove that radiation levels in the survey area do not exceed those in the background area plus the DCGL and therefore may be released from radiological controls.

The biased, sub-surface soil samples will be analyzed for radium-226 and isotopic thorium (for Th-230 assessment) as a further check to determine if any sub-surface migration of contamination had occurred.

Appendix A – Results of RESRAD Analysis of 5 pCi/g Ra-226 and 60 pCi/g Th-230

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RESRAD-OFFSITE, Version 3.2         T« Limit = 30 days         07/26/2020  18:12  Page  36
Parent Dose Report
Title : Mt Kisco Ra226 5 pCi/g & Th-230 60 pCi/g
File  : MTKISCOWWTP.ROF

     Contaminated Zone Dimensions           Initial Soil Concentrations, pCi/g
     ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ          ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
       Area:  10000.00 square meters              Pb-210     5.000E+00
  Thickness:      2.00 meters                     Po-210     5.000E+00
Cover Depth:      0.00 meters                     Ra-226     5.000E+00
                                                  Th-230     6.000E+01

                     Total Dose TDOSE(t), mrem/yr
                Basic Radiation Dose Limit =  2.500E+01 mrem/yr
  Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
   t (years):  0.000E+00  1.000E+00  1.000E+01  5.000E+01  1.000E+02  3.000E+02
    TDOSE(t):  9.471E+00  9.652E+00  9.935E+00  1.074E+01  1.164E+01  1.423E+01
        M(t):  3.788E-01  3.861E-01  3.974E-01  4.296E-01  4.658E-01  5.693E-01

Maximum TDOSE(t):  1.451E+01 mrem/yr at t = 330 years
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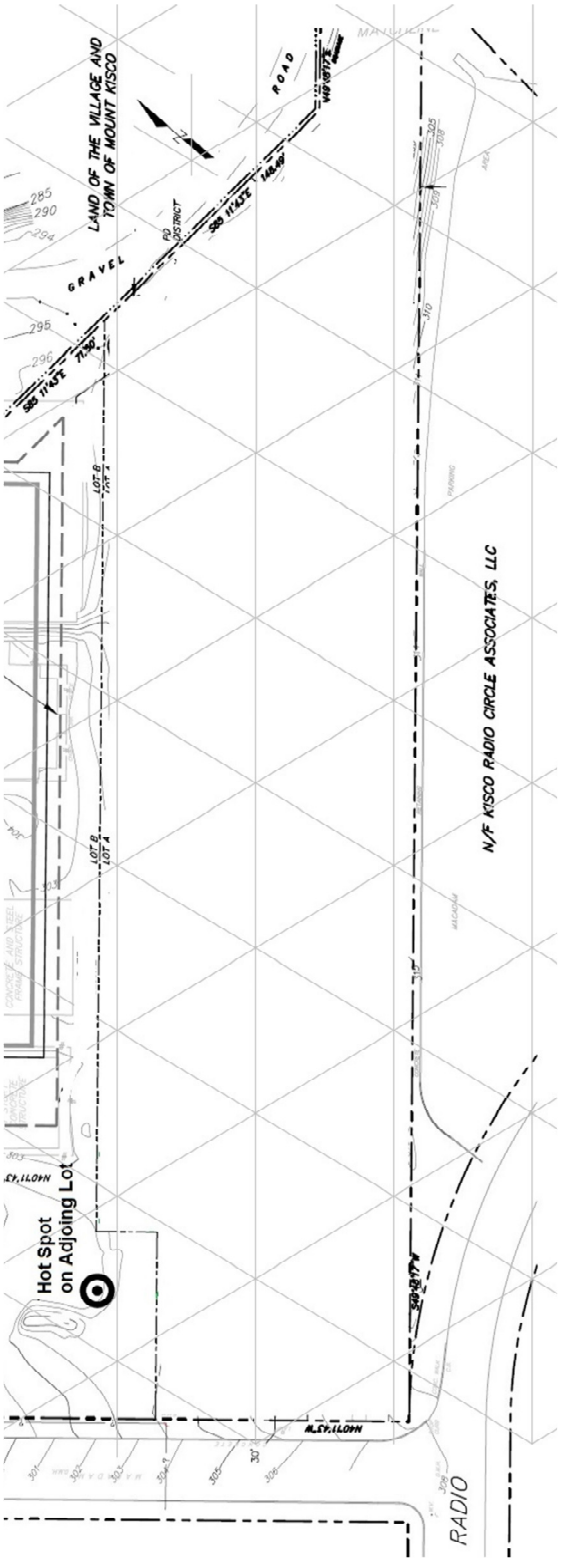
Appendix B – Grid Layout



Appendix C – Drawing of Proposed Lot A Development with Proposed Borehole Sampling Locations Shown