

CHARACTERIZATION AND ASSESSMENT OF AREAS OF INTEREST

**RADIATION HEALTH BRANCH
RADIATION/ENVIRONMENTAL MONITORING SECTION**

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Introduction

In April 2008, a list of Areas of Interest (AOIs) was provided to the Radiation Health Branch (RHB) for investigation of potential radiation impacts. It was alleged that dumping of radioactive material from the Paducah Gaseous Diffusion Plant had occurred in these AOIs. Based on the information provided to RHB, a work plan with associated quality assurance quality control procedures was established to investigate the AOIs accessible to the RHB staff.

Based on GPS coordinates or descriptions of the AOIs provide to RHB, a number of AOIs could not be located by staff of the RHB. Areas were also inaccessible due to dense underbrush or fences. Table 1 provides a summary of the actions taken by RHB staff for each of the AOIs.

Table 1. List of AOIs and Actions by RHB Staff for Each Location

| Location Number | Action Taken by RHB |
|------------------------|---|
| AOI 01: | SWMU 126B. Did not survey or sample. |
| AOI 02: | SWMU 124. Did not survey or sample. |
| AOI 03: | Unable to locate a “gravel pit” at this location. Did not survey or sample. |
| AOI 04: | Large, fenced area with signs “Danger Keep Out Deep Holes”. Did not survey or sample. |
| AOI 05: | SWMU 094. Did not survey or sample. |
| AOI 06: | Large area with old growth trees and no visible anomalies. Did not survey or sample. |
| AOI 07: | Swiped, surveyed and sampled |
| AOI 08: | Swiped and surveyed (GPS lost during survey) |
| AOI 09: | SWMU 113 & 114: Swiped, surveyed and sampled |
| AOI 10: | Bridge with signs “Caution controlled area, fixed contamination area, TLD Required, Contact HP prior to disturbing surfaces”. Did not survey or sample. |
| AOI 11: | WAG 17. Did not survey or sample. |
| AOI 12: | Location not released by security. |
| AOI 13: | Surveyed and sampled |
| AOI 14: | SWMU 126B. Did not survey or sample. |
| AOI 15A: | Swiped, surveyed and sampled |
| AOI 15B: | Surveyed and sampled |
| AOI 16: | SWMU 145. Did not survey or sample. |
| AOI 17: | SWMU 180. Did not survey or sample. |
| AOI 18: | Swiped, surveyed and sampled |
| AOI 19: | Located area with dense underbrush, but did not find any indications of dumped material. Did not survey or sample. |
| AOI 20: | Swiped and surveyed |

Table 1. List of AOIs and Actions by RHB Staff for Each Location (continued)

| Location Number | Action Taken by RHB |
|------------------------|--|
| AOI 21: | Location not released by security. |
| AOI 22: | Location not released by security. |
| AOI 23: | Location not released by security. |
| AOI 24: | SWMU 125. Did not survey or sample. |
| AOI 25: | Very large area with dense underbrush. Did not survey or sample. |
| AOI 26: | Unable to locate using supplied GPS coordinates |
| AOI 27: | Surveyed and sampled |
| AOI 28: | Unable to locate using supplied GPS coordinates |
| AOI 29: | Inside fenced area. Did not survey or sample. |
| AOI 30: | SWMU 129 & 181. Surveyed and sampled |
| FC 01: | Swiped, surveyed and sampled |
| FC 02: | Did not visit. |
| FC 03: | Surveyed and sampled |
| FC 3.5: | Did not visit. |
| FC 04: | Did not visit. |
| FC 05: | Did not visit. |
| FC 06: | See AOI 07 & 15A |
| FC 07: | See AOI 07 & 15A |

Area of Interest Survey and Sampling

Eleven (11) of the AOIs listed in Table 1 were investigated in detail by the RHB. Ten (10) of the eleven (11) AOIs are shown in Figure 1. Coordinates for AOI 08 were not captured during the gamma walkover survey (GWS) but the coordinates for AOI 08 were captured during investigation of the location. Figure 2 shows the location of AOI 08.

At each of the AOIs shown in Figure 1, a GWS was conducted and a composite sample was collected based on the initial results of the GWS. Based on the initial GWS result, a twenty-five (25) square meter (m²) area was established for sample collection. GPS coordinates were taken at the center and four (4) corners of the 25 m² area. Discrete static gamma ray dose rate measurements were taken at the center and each corner. One (1) increment soil sample was collected from the center and each of the corners. The five increment soil samples were composited to form one multi-increment composite soil sample for fixed based laboratory analysis at the RHB laboratory in Frankfort, Kentucky.

Analysis of the multi-increment soil samples was based on process history for the PGDP. Each multi-increment soil sample was analyzed by liquid scintillation for technetium-99 (⁹⁹Tc), gamma spectroscopy for americium (²⁴¹Am), protactinium-233 (²³³Pa), uranium-238 (²³⁸U), and cesium-137 (¹³⁷Cs), alpha spectroscopy for uranium isotopes (uranium 234 (²³⁴U), uranium-235 (²³⁵U), uranium-238 (²³⁸U), plutonium-238 (²³⁸Pu), and plutonium-239 (²³⁹Pu). For gamma spectroscopy, protactinium-233 is used as a surrogate

for neptunium-237 (^{237}Np) and thorium-234 (^{234}Th) and protactinium-234m ($^{234\text{m}}\text{Pa}$) are used as surrogates for ^{238}U .

Data Verification and Validation

All results including GWSs were verified and validated. Data verification is conducted by the RHB and data validation by an independent third party. Validation was conducted by an independent third party radiochemist. Analytical results are screened against a number of criteria. At a minimum, a data package is checked to determine whether sufficient information is present to independently follow the field collection procedures, sample control, analytical methods, data reduction, and quality control.

The following is the sequence used to evaluate data produced by the RHB. The data is evaluated to determine if: (1) each result has a sample specific minimum detectable concentration (MDC); (2) each sample has a sample-specific activity for each specific analysis; (3) each sample has a sample-specific counting uncertainty; (4) the reported activity does or does not exceed the sample-specific MDC; (5) the sample-specific counting uncertainty does or does not exceed 50% of the sample activity; (6) each set of data has appropriate quality control; and (7) sampling was conducted according to the sampling and analysis plan.

Results

AOI 07 & 15A

Figure 3 shows the GWS for AOIs 07 & 15A. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microrentgen/hour ($\mu\text{R/hr}$) set by the sampling and analysis plan for AOIs. Swipes of concrete analyzed by gross alpha/beta were less than critical count levels (not detected). Table 2 provides the isotopic analytical data for the 5 sample multi-increment soil sample collected from the area.

Table 2. Radiation Activity for the Multi-Increment Soil Sample at AOI 07 & 15A

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 0.82 | 0.12 | 0.02 | 52.2 | 2.5 |
| uranium-235 | 0.08 | 0.03 | 0.02 | 0.826* | 0.14 |
| uranium-238 | 0.99 | 0.13 | 0.01 | 3.62* | 1.2 |
| plutonium-238 | 0.03 | 0.03 | 0.04 | 31.0 | 0.073 |
| plutonium-239 | 0.01 | 0.02 | 0.03 | 30.3 | 0.025 |
| cesium-137 | 0.21 | 0.02 | 0.02 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | 0.14 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty

^bMDC = Minimal Detectable Concentration

^cDOE "Risk Methods Document (2000)" Table A.17

^d"Risk Methods Document (2000)" Table A.12

^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹

*Values are for $^{238}\text{U}+\text{D}$; $^{235}\text{U}+\text{D}$, Cs-137+D

Based on RHB’s characterization and assessment of AOI 07 & 15A, the isotopes were below the no action level, except for ¹³⁷Cs, for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000². The ¹³⁷Cs activity, although greater than the teen recreational user, is less than the PGDP background soil level of 0.49 pCi/g (Table A.12, Reference 2) and global fallout levels for ¹³⁷Cs¹.

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose and not risk, the radiation dose for AOI 07 & 15A is below the 1 mrem/yr Negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

AOI 09

Figure 4 shows the GWS for AOI 09. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microroentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Swipes of concrete analyzed by gross alpha/beta were less than critical count levels (not detected). Table 3 provides the isotopic analytical data for the 5 sample multi-increment soil sample collected from the area.

Table 3. Radiation Activity for the Multi-Increment Soil Sample at AOI 09

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 2.38 | 0.29 | 0.01 | 52.2 | 2.5 |
| uranium-235 | 0.18 | 0.05 | 0.02 | 0.826* | 0.14 |
| uranium-238 | 3.34 | 0.39 | 0.01 | 3.62* | 1.2 |
| plutonium-238 | 0.26 | 0.15 | 0.16 | 31.0 | 0.073 |
| plutonium-239 | 0.35 | 0.17 | 0.11 | 30.3 | 0.025 |
| cesium-137 | 0.27 | 0.02 | 0.014 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | 25.8 | 0.16 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty

^bMDC = Minimal Detectable Concentration

^cDOE “Risk Methods Document (2000)” Table A.17

^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹

^e“Risk Methods Document (2000)” Table A.12

*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

The presence of ²³⁸U, ²³⁵U, ²³⁴U, ⁹⁹Tc, ²³⁸Pu, and ²³⁹Pu above PGDP background levels² indicates the material at AOI 09 originated from PGDP related activity. Based on RHB’s characterization and assessment of AOI 09, the isotopes were below the no action level, except for ¹³⁷Cs, for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000². The ¹³⁷Cs activity, although greater than the teen recreational user, is less than the PGDP background soil level of 0.49 pCi/g (Table A.12, Reference 2) and global fallout levels for ¹³⁷Cs¹.

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose and not risk, the radiation dose is below the 1 mrem/yr Negligible

Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

AOI 13

Figure 5 shows the GWS for AOI 13. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microroentgen/hour ($\mu\text{R/hr}$) set by the sampling and analysis plan for AOIs. Table 4 provides the isotopic analytical data for the 5 sample multi-increment soil sample collected from the area.

Table 4. Radiation Activity for the Multi-Increment Soil Sample at AOI 13

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 0.91 | 0.12 | 0.01 | 52.2 | 2.5 |
| uranium-235 | 0.06 | 0.03 | 0.01 | 0.826* | 0.14 |
| uranium-238 | 1.03 | 0.13 | 0.02 | 3.62* | 1.2 |
| plutonium-238 | 0.06 | 0.03 | 0.04 | 31.0 | 0.073 |
| plutonium-239 | 0.01 | 0.02 | 0.03 | 30.3 | 0.025 |
| cesium-137 | 0.32 | 0.02 | 0.02 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | 0.13 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty

^bMDC = Minimal Detectable Concentration

^cDOE “Risk Methods Document (2000)” Table A.17

^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹

^e“Risk Methods Document (2000)” Table A.12

*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

Based on RHB’s characterization and assessment of AOI 13, the isotopes were below the no action level, except for ¹³⁷Cs, for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000². The ¹³⁷Cs activity, although greater than the teen recreational user, is less than the PGDP background soil level of 0.49 pCi/g (Table A.12, Reference 2) and global fallout levels for ¹³⁷Cs¹.

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose and not risk, the radiation dose is below the 1 mrem/yr Negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

AOI 15B

Figure 6 shows the GWS for AOI 15B. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microroentgen/hour ($\mu\text{R/hr}$) set by the sampling and analysis plan for AOIs. Table 5 provides the isotopic analytical data for the 5 sample multi-increment soil sample collected from the area.

Based on RHB’s characterization and assessment of AOI 15B, the isotopes were below the no action level for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000².

Table 5. Radiation Activity for the Multi-Increment Soil Sample at AOI 15B

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 1.16 | 0.15 | 0.0005 | 52.2 | 2.5 |
| uranium-235 | 0.09 | 0.03 | 0.01 | 0.826* | 0.14 |
| uranium-238 | 1.29 | 0.16 | 0.0005 | 3.62* | 1.2 |
| plutonium-238 | 0.02 | 0.03 | 0.05 | 31.0 | 0.073 |
| plutonium-239 | 0.01 | 0.01 | 0.02 | 30.3 | 0.025 |
| cesium-137 | 0.10 | 0.02 | 0.016 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | 0.81 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty^bMDC = Minimal Detectable Concentration^cDOE "Risk Methods Document (2000)" Table A.17^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹^e"Risk Methods Document (2000)" Table A.12*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose rather than risk, the radiation dose is below the 1 mrem/yr Negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

AOI 18

Figure 7 shows the GWS for AOI 18. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microroentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Swipes of concrete analyzed by gross alpha/beta were less than critical count levels (not detected). Table 6 provides the isotopic analytical data for the 5 sample multi-increment sample that was collected from the area. The sample was comprised of a significant quantity of fine gravel.

Table 6. Radiation Activity for the Multi-Increment Soil Sample at AOI 18

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 0.44 | 0.07 | 0.005 | 52.2 | 2.5 |
| uranium-235 | 0.03 | 0.01 | 0.01 | 0.826* | 0.14 |
| uranium-238 | 0.48 | 0.08 | 0.02 | 3.62* | 1.2 |
| plutonium-238 | 0.04 | 0.03 | 0.05 | 31.0 | 0.073 |
| plutonium-239 | 0.01 | 0.02 | 0.04 | 30.3 | 0.025 |
| cesium-137 | 0.00 | 0.01 | 0.02 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | 0.13 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty^bMDC = Minimal Detectable Concentration^cDOE "Risk Methods Document (2000)" Table A.17^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹^e"Risk Methods Document (2000)" Table A.12*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

Based on RHB’s characterization and assessment of AOI 18, the isotopes were below the no action level for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000².

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose rather than risk, the radiation dose is below the 1 mrem/yr negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

AOI 08

A survey was conducted but coordinates were not recorded for AOI 08; therefore, a map could not be developed detailing the results of GWS. The gamma ray dose rate for the area surveyed was less than the trigger of 30 microrentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Swipes of concrete analyzed by gross alpha/beta were less than critical count levels (not detected). Soil samples were not collected because materials at this AOI were comprised of concrete pieces.

AOI 20

Figure 8 shows the GWS for AOI 20. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microrentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Swipes of concrete analyzed by gross alpha/beta were less than critical count levels (not detected). Soil samples were not collected because materials at this AOI were comprised of concrete pieces.

AOI 27

Figure 9 shows the GWS for AOI 27. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microrentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Table 7 provides the isotopic analytical data for the 5 sample multi-increment sample that was collected from the area. The sample was comprised of a significant quantity of fine gravel.

Table 7. Radiation Activity for the Multi-Increment Soil Sample at AOI 27

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 0.36 | 0.06 | 0.01 | 52.2 | 2.5 |
| uranium-235 | 0.02 | 0.01 | 0.01 | 0.826* | 0.14 |
| uranium-238 | 0.41 | 0.07 | 0.03 | 3.62* | 1.2 |
| plutonium-238 | 0.05 | 0.03 | 0.04 | 31.0 | 0.073 |
| plutonium-239 | 0.00 | 0.01 | 0.02 | 30.3 | 0.025 |
| cesium-137 | 0.02 | 0.01 | 0.01 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | -0.07 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty

^bMDC = Minimal Detectable Concentration

^cDOE “Risk Methods Document (2000)” Table A.17

^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹

^e“Risk Methods Document (2000)” Table A.12

*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

Based on RHB’s characterization and assessment of AOI 27, the isotopes were below the no action level for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000².

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose rather than risk, the radiation dose is below the 1 mrem/yr Negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

AOI 30

Figure 10 shows the GWS for AOI 30. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microroentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Table 8 provides the isotopic analytical data for the 5 sample multi-increment soil sample that was collected from the area.

Table 8. Radiation Activity for the Multi-Increment Soil Sample at AOI 30

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 0.54 | 0.08 | 0.01 | 52.2 | 2.5 |
| uranium-235 | 0.03 | 0.02 | 0.02 | 0.826* | 0.14 |
| uranium-238 | 0.66 | 0.09 | 0.01 | 3.62* | 1.2 |
| plutonium-238 | 0.06 | 0.03 | 0.04 | 31.0 | 0.073 |
| plutonium-239 | 0.03 | 0.02 | 0.02 | 30.3 | 0.025 |
| cesium-137 | 0.07 | 0.01 | 0.01 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | 0.05 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty

^bMDC = Minimal Detectable Concentration

^cDOE “Risk Methods Document (2000)” Table A.17

^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹

^e“Risk Methods Document (2000)” Table A.12

*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

Based on RHB’s characterization and assessment of AOI 30, the isotopes were below the no action level for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000².

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose rather than risk, the radiation dose is below the 1 mrem/yr Negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

FC 01

Figure 11 shows the GWS for FC 01. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microroentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Swipes of concrete analyzed by

gross alpha/beta were less than critical count levels (not detected). Table 9 provides the isotopic analytical data for the 5 sample multi-increment sample that was collected from the area. The sample was comprised of a significant quantity of fine gravel.

Based on RHB’s characterization and assessment of FC 01, the isotopes were below the no action level for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000².

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose rather than risk, the radiation dose is below the 1 mrem/yr Negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

Table 9. Radiation Activity for the Multi-Increment Soil Sample at FC 01

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 0.61 | 0.08 | 0.02 | 52.2 | 2.5 |
| uranium-235 | 0.02 | 0.01 | 0.02 | 0.826* | 0.14 |
| uranium-238 | 0.67 | 0.08 | 0.01 | 3.62* | 1.2 |
| plutonium-238 | 0.03 | 0.03 | 0.04 | 31.0 | 0.073 |
| plutonium-239 | 0.00 | 0.01 | 0.03 | 30.3 | 0.025 |
| cesium-137 | 0.03 | 0.02 | 0.02 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | -0.01 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty

^bMDC = Minimal Detectable Concentration

^cDOE “Risk Methods Document (2000)” Table A.17

^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹

^e“Risk Methods Document (2000)” Table A.12

*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

FC 03

Figure 12 shows the GWS for FC 03. Based on the results of the GWS, the gamma ray dose rate within the area surveyed was less than the trigger of 30 microroentgen/hour (µR/hr) set by the sampling and analysis plan for AOIs. Table 10 provides the isotopic analytical data for the 5 sample multi-increment sample that was collected from the area.

Based on RHB’s characterization and assessment of FC 03, the isotopes were below the no action level for the teen recreational user in Table A.17 of DOE’s Risk Methods Document 2000².

Kentucky radiation statutes and regulations require assessments of radiation to be based on radiation dose rather than risk, the radiation dose is below the 1 mrem/yr Negligible Individual Risk Level established in NCRP Report No. 116 and meets the release limits established in 902 KAR 100:042.

Table 10. Radiation Activity for the Multi-Increment Soil Sample at FC 03

| Isotope | Activity (pCi/g) | CU ^a (pCi/g) | MDC ^b (pCi/g) | Soil NAL For Teen Recreational User (pCi/g) ^c | PGDP Background Levels ^e (pCi/g) |
|---------------|------------------|-------------------------|--------------------------|--|---|
| uranium-234 | 0.44 | 0.07 | 0.01 | 52.2 | 2.5 |
| uranium-235 | 0.03 | 0.02 | 0.01 | 0.826* | 0.14 |
| uranium-238 | 0.48 | 0.08 | 0.02 | 3.62* | 1.2 |
| plutonium-238 | 0.17 | 0.05 | 0.03 | 31.0 | 0.073 |
| plutonium-239 | 0.01 | 0.01 | 0.02 | 30.3 | 0.025 |
| cesium-137 | 0.03 | 0.01 | 0.02 | 0.178 ^{d,*} | 0.49 |
| technetium-99 | -0.02 | 0.07 | 0.23 | 926.0 | 2.5 |

^aCU = counting uncertainty

^bMDC = Minimal Detectable Concentration

^cDOE “Risk Methods Document (2000)” Table A.17

^dValue is below PGDP background of 0.49 pCi/g and fallout value of 1 pCi/g¹

^e“Risk Methods Document (2000)” Table A.12

*Values are for ²³⁸U+D; ²³⁵U+D, Cs-137+D

Summary

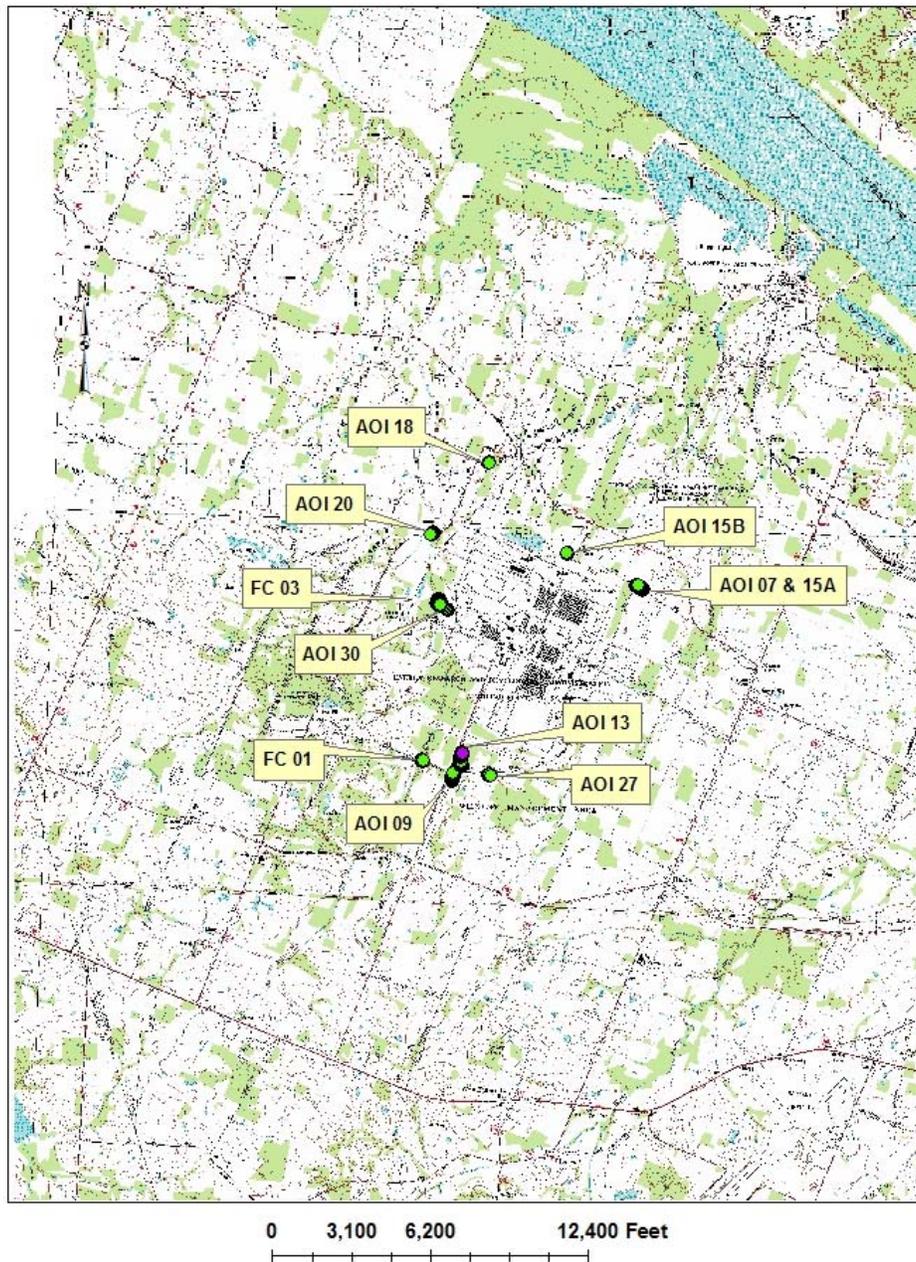
One AOI has radionuclides that are associated with PGDP process activities. AOI 09 soil has ²³⁴U, ²³⁵U, ²³⁸U, ²³⁸Pu, ²³⁹Pu, and ⁹⁹Tc associated with plant process activities. The observed levels of the above isotopes are at levels exceeding background soil levels for PGDP soils. Based on the levels of the listed isotopes, AOI 09 contamination appears to have originated from plant process activities. Although the levels are greater than the backgrounds for the listed isotopes, the activity of the isotopes is less than the no action levels in DOE’s Risk Methods Document 2000 Table A.17².

Based on characterization and assessment of data collected by the RHB for the AOIs, the areas investigated do not represent a threat to public health.

References

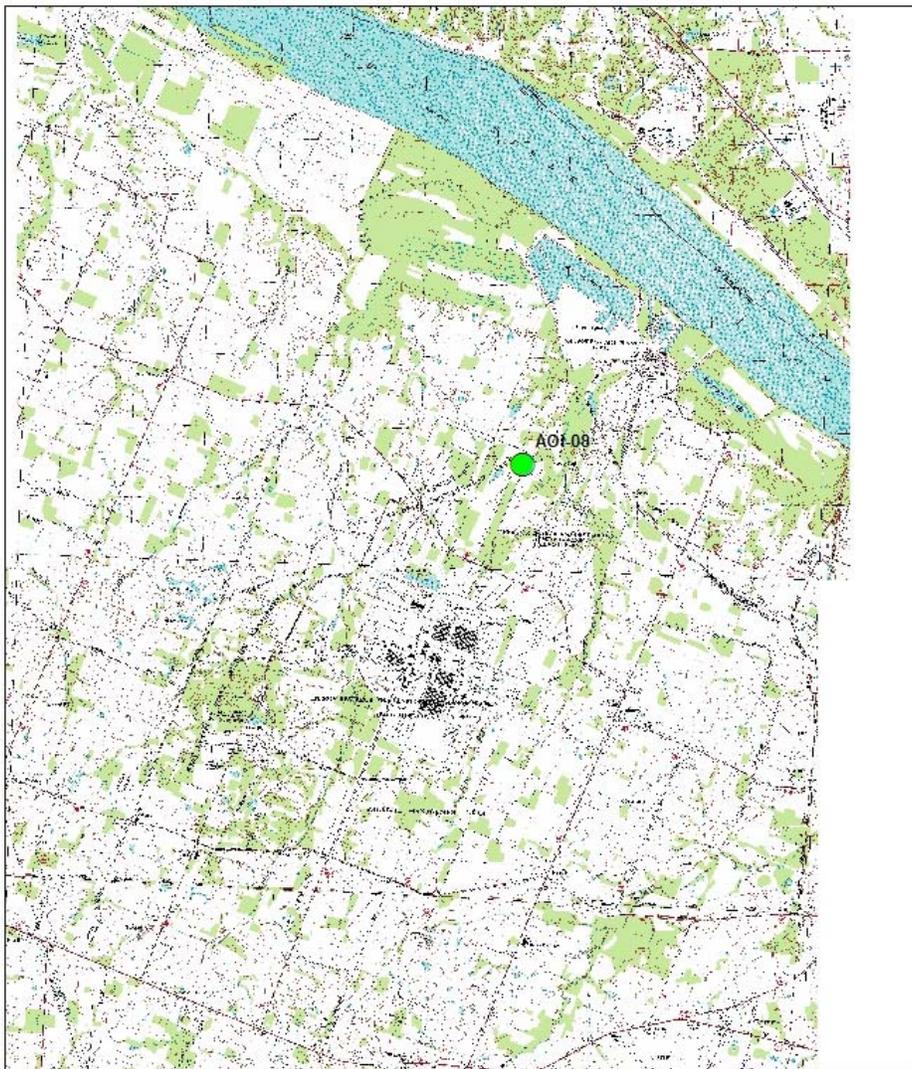
1. Argonne National Laboratory. “Radiological and Chemical Fact Sheets to Support Health Risk Analyses for contaminated areas.
2. DOE. “Method for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health” (DEO/OR/07-1506&D2, December 2000).

FIGURES



Radiation Surveys for Areas of Interest

Figure 1. Radiation Surveys for Areas of Interest



0 3,750 7,500 15,000 Feet

AOI 08 Location

Figure 2. Location of AOI 08

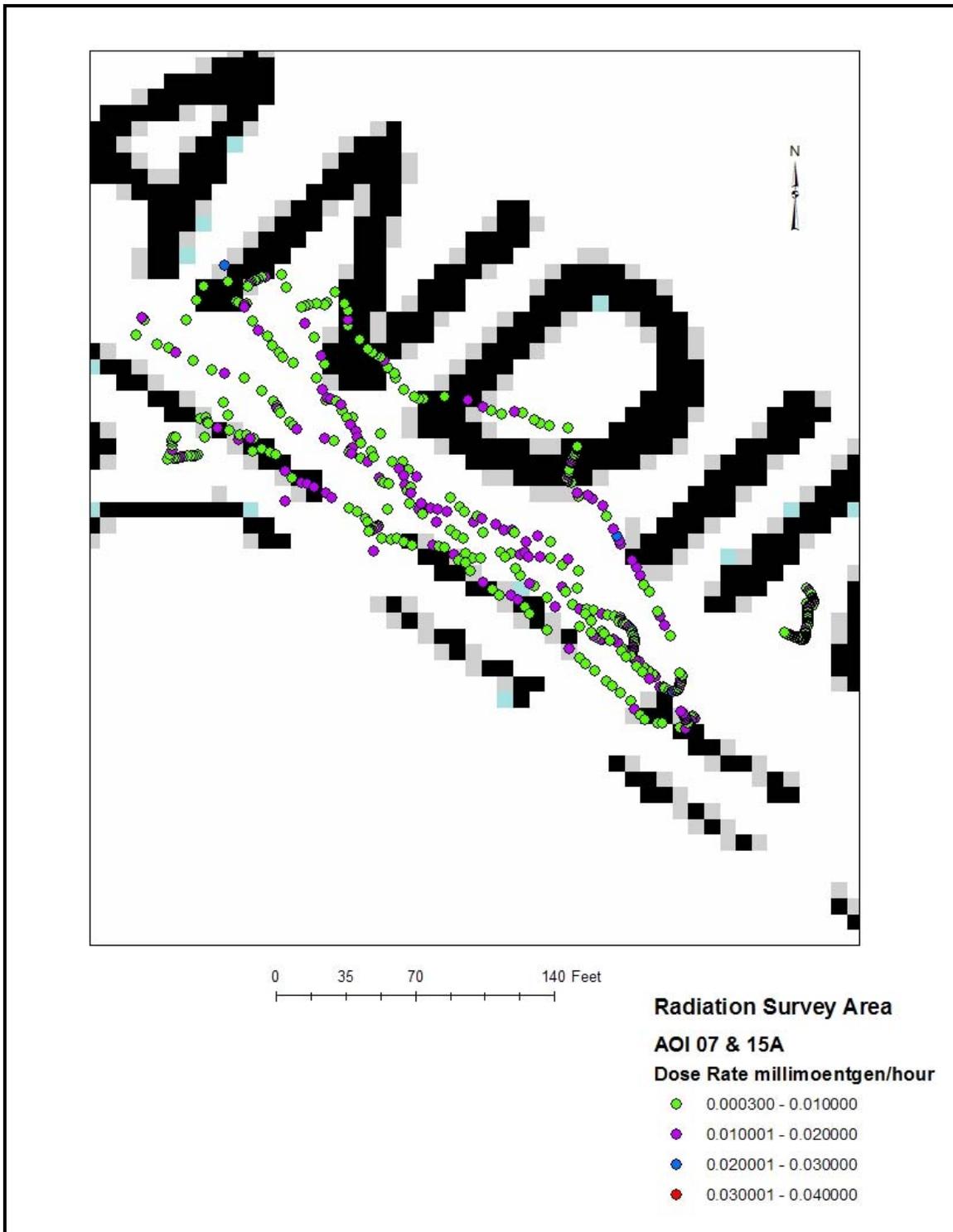


Figure 3. Radiation Survey of AOI 07 & 15A

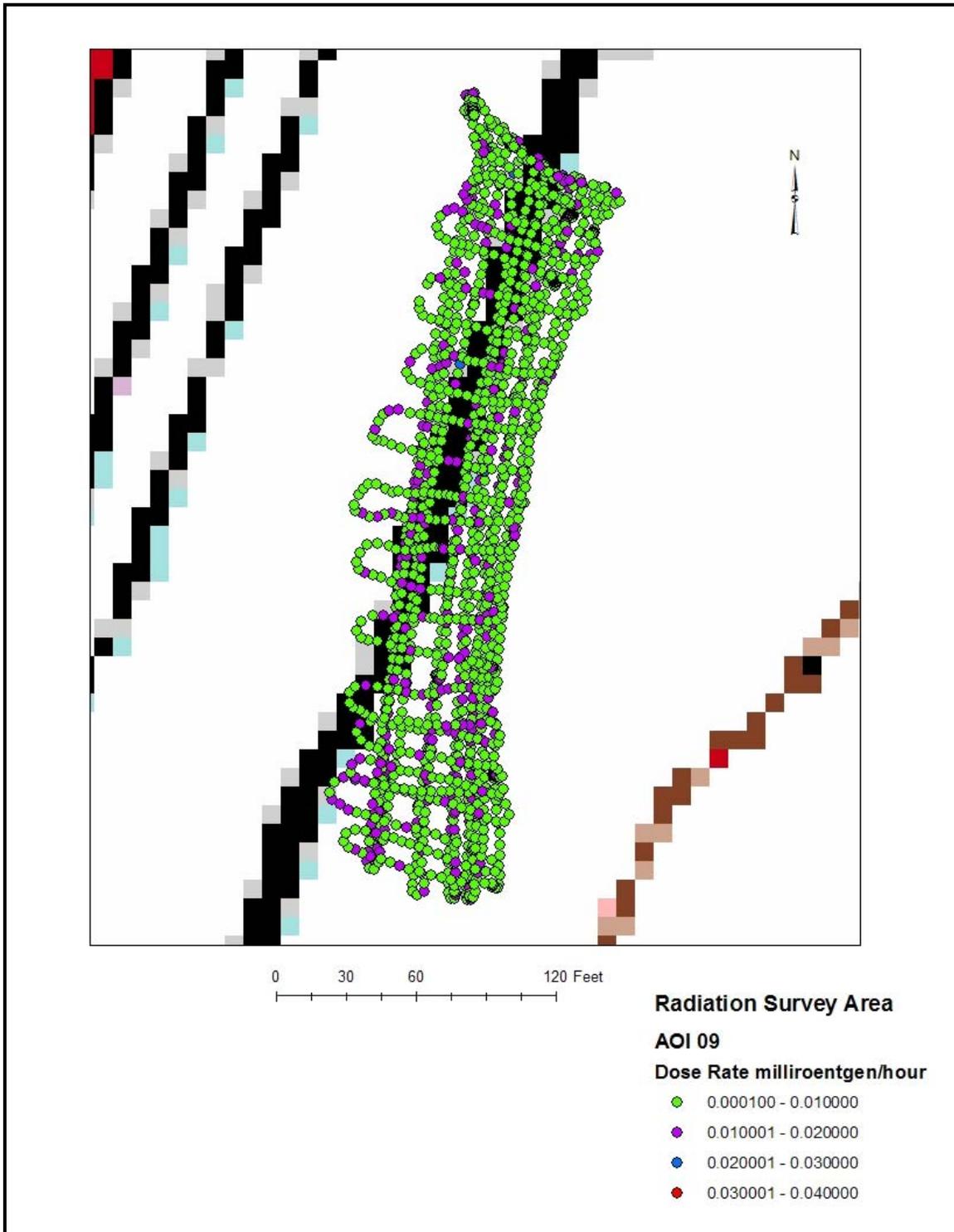


Figure 4. Radiation Survey of AOI 09

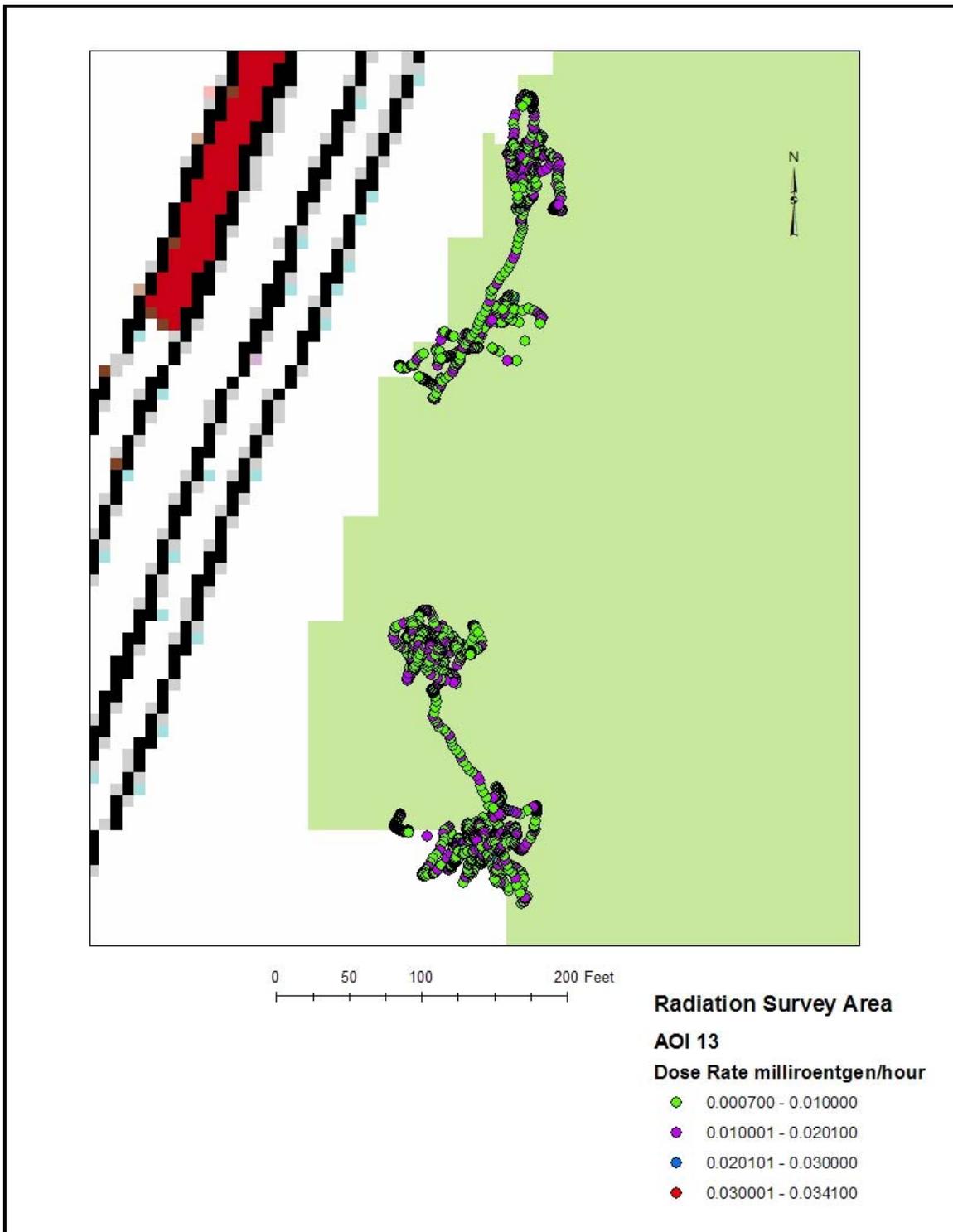


Figure 5. Radiation Survey of AOI 13

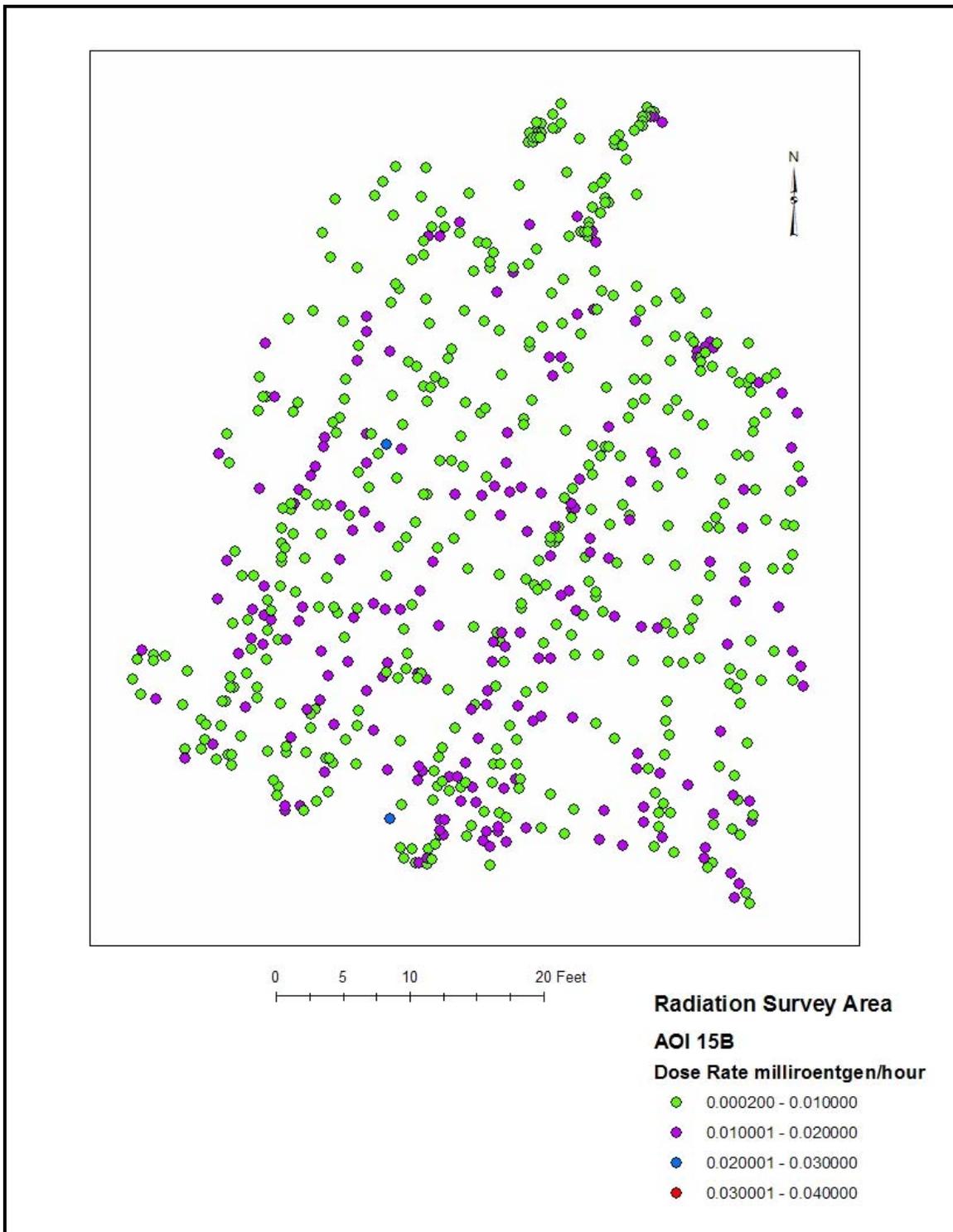


Figure 6. Radiation Survey of AOI 15B

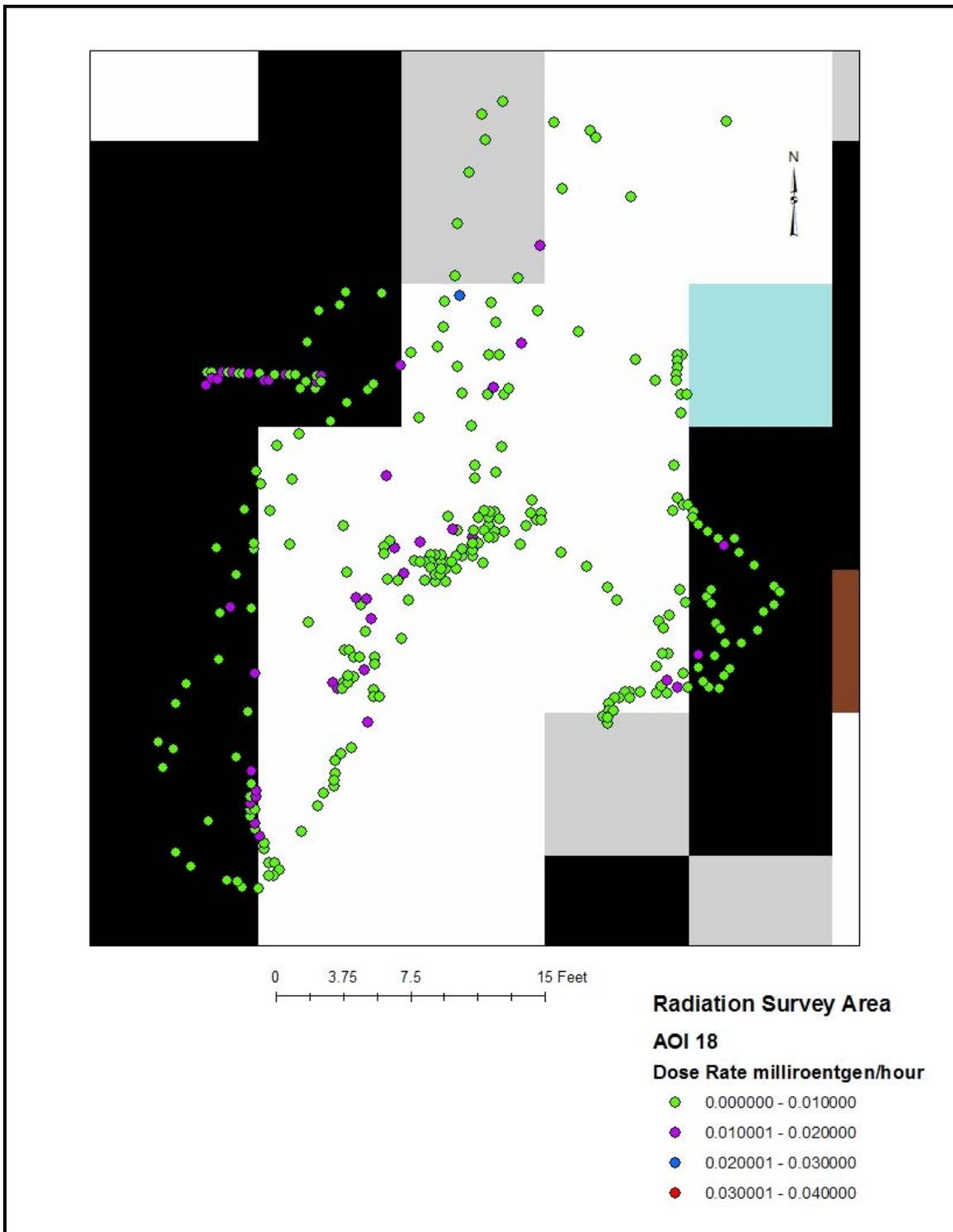


Figure 7. Radiation Survey of AOI 18

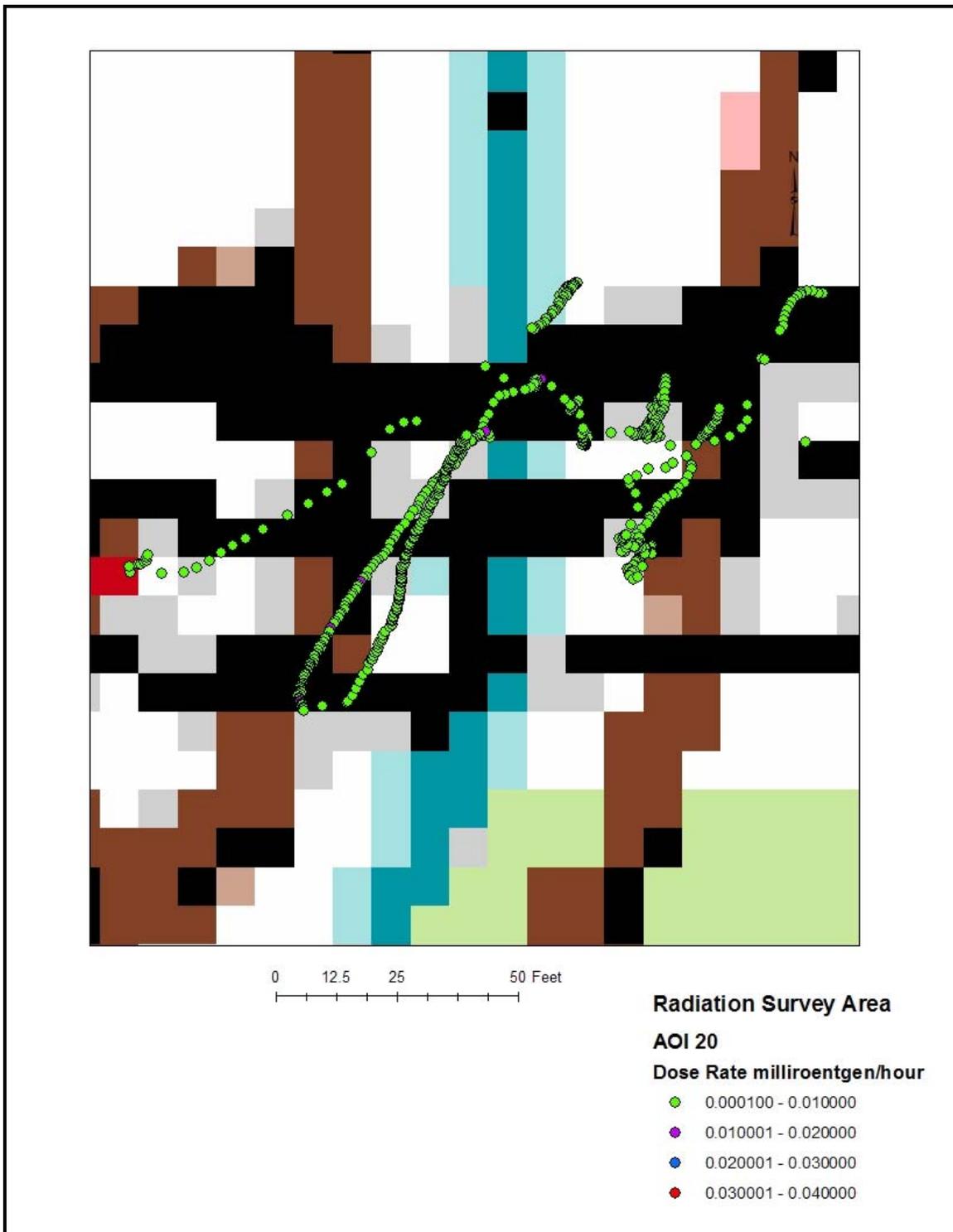


Figure 8. Radiation Survey of AOI 20

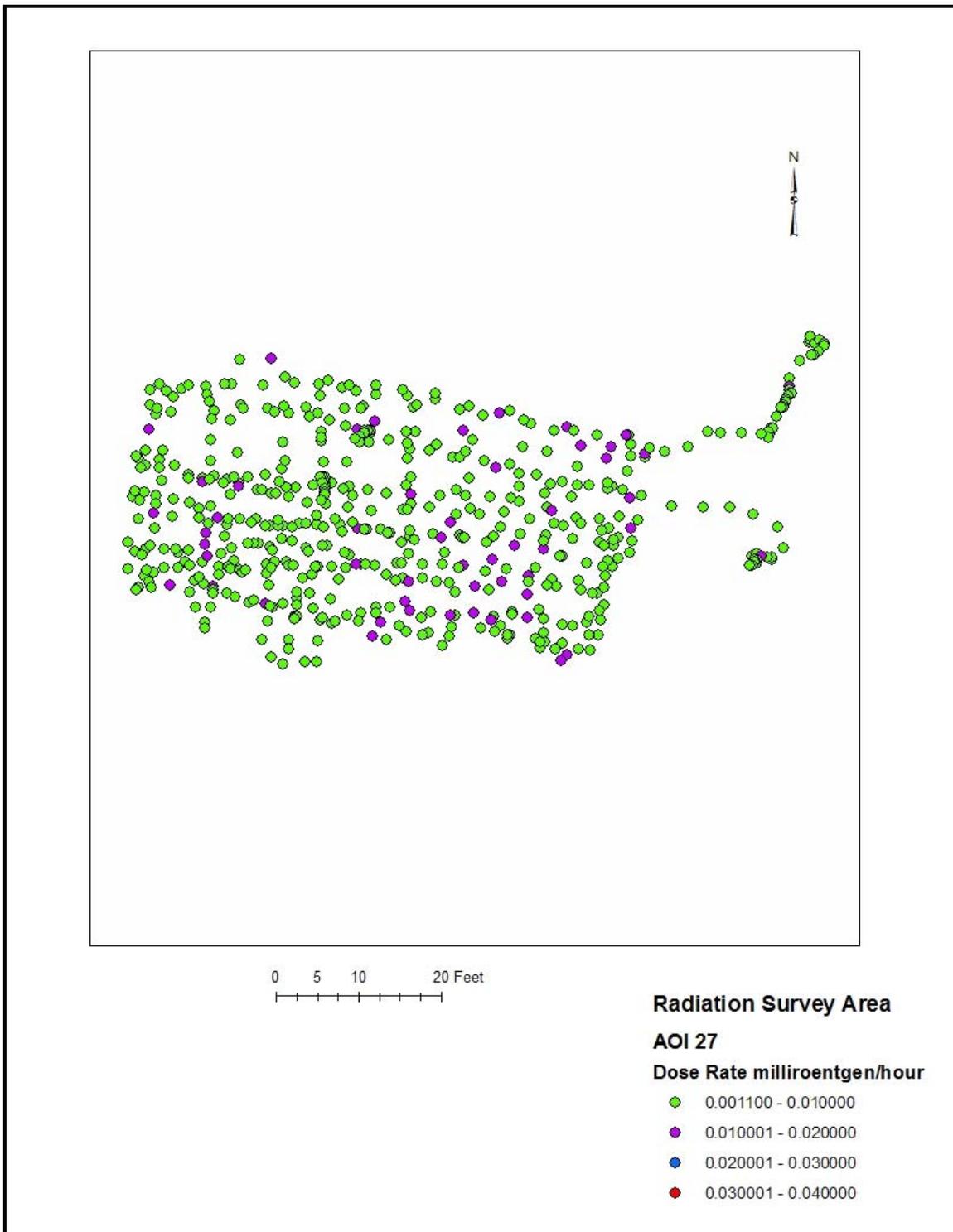


Figure 9. Radiation Survey of AOI 27

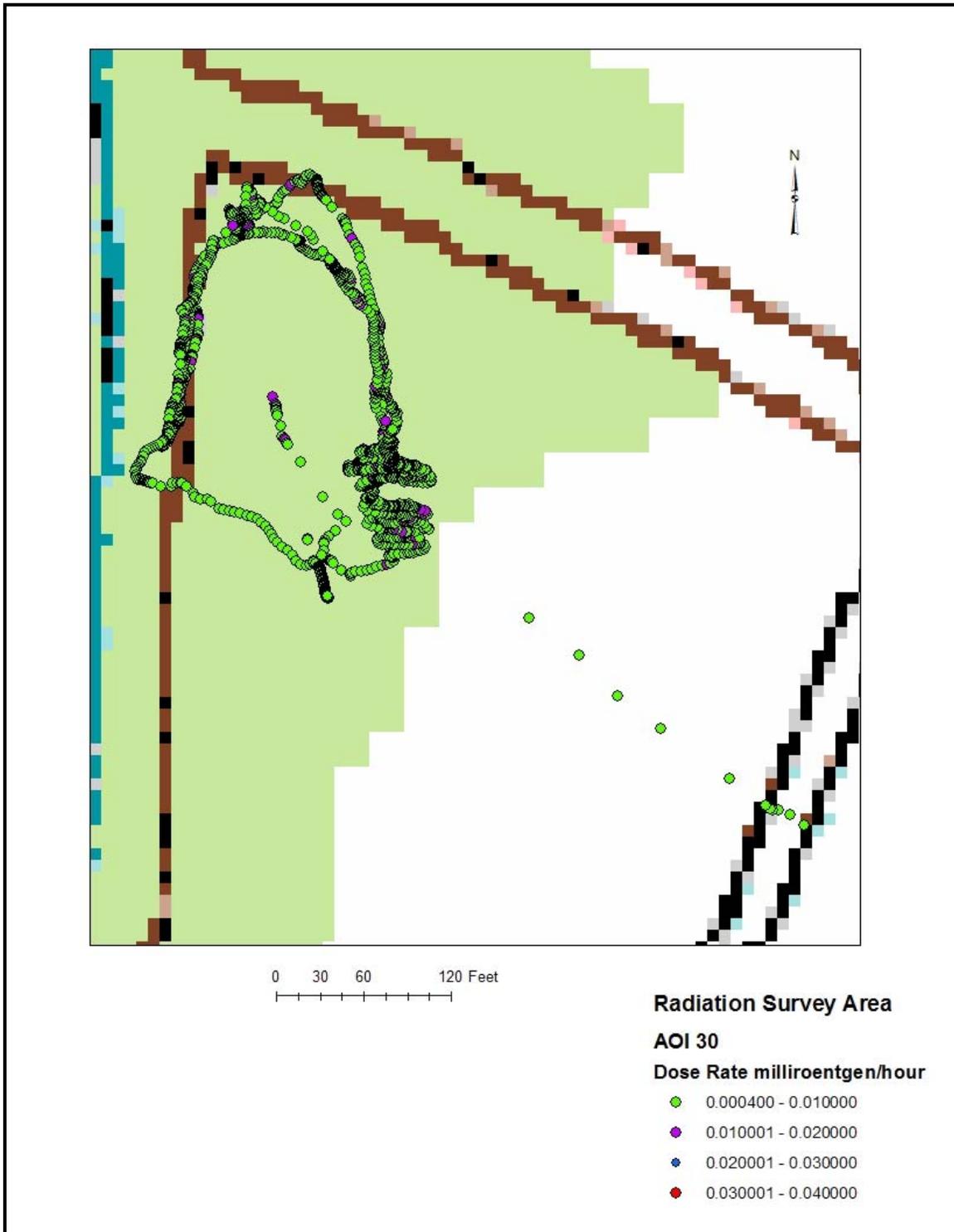


Figure 10. Radiation Survey of AOI 30

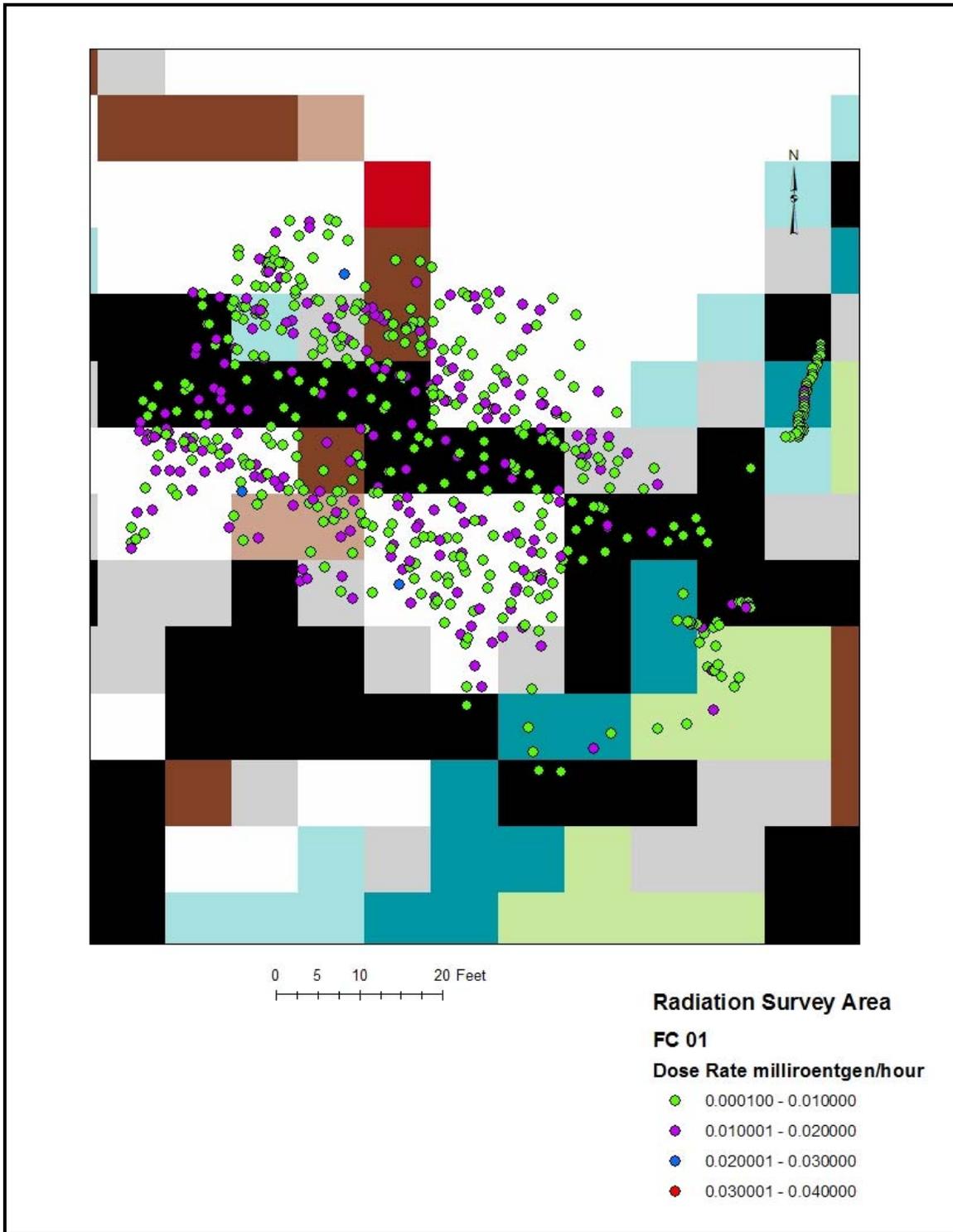


Figure 11. Radiation Survey of FC 01

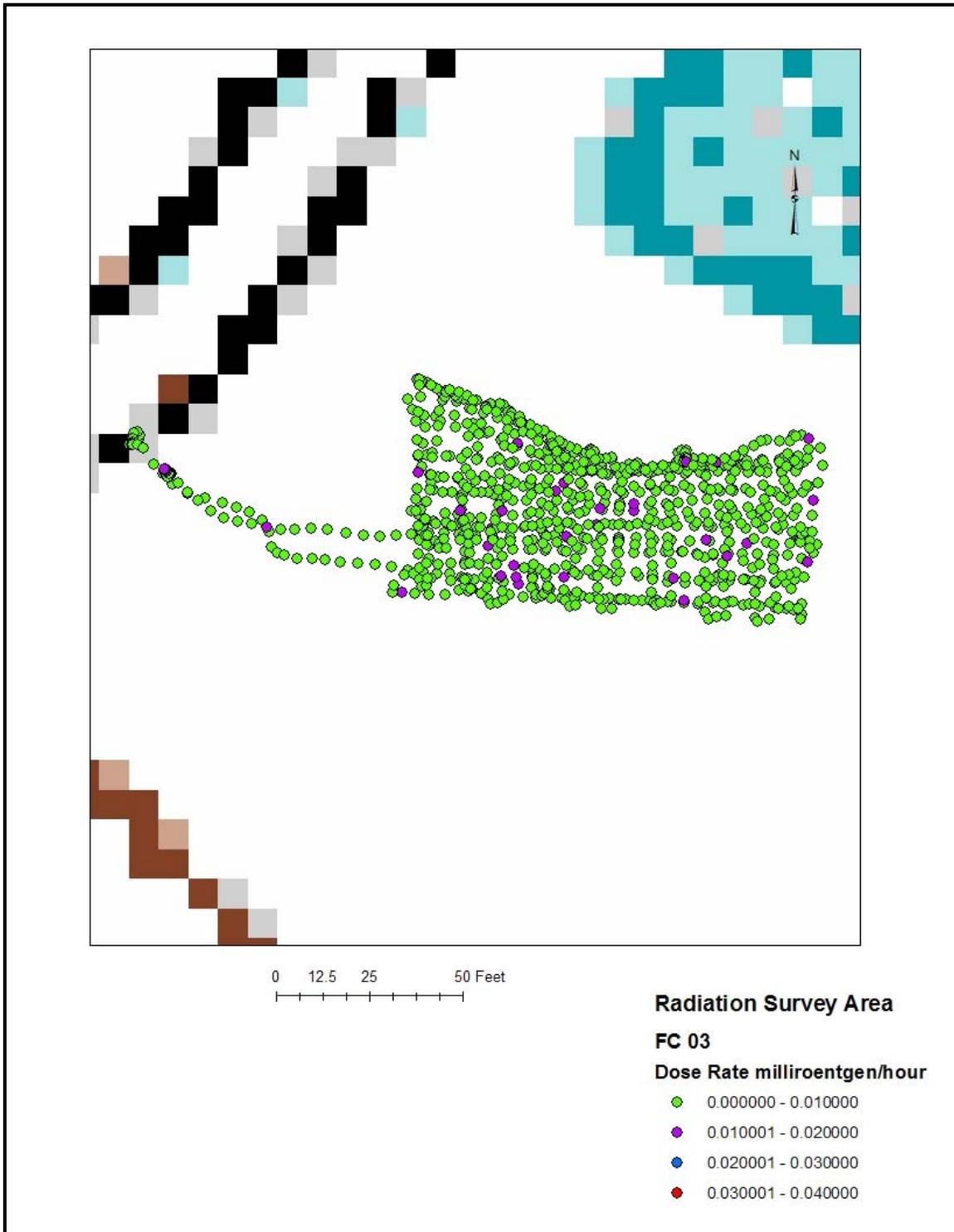


Figure 12. Radiation Survey of FC 03