ADDENDUM 2.9-B

BASELINE GAMMA RADIATION SURVEY

AND SOIL RADIUM-226 CORRELATION REPORT

Baseline Gamma Radiation Survey and Soil Radium-226 Correlation Report

for the

Ross Proposed *In-Situ* Uranium Recovery Site

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PROFESSIONAL DECLARATION

This report was prepared by Tetra Tech, Inc. under the professional supervision of H. Robert Meyer. The findings, recommendations, specifications and professional opinions presented in this report have been prepared in accordance with generally accepted professional radiation protection and measurements practice, as constrained by project scope. There is no warranty, either expressed or implied.

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1.0 INTRODUCTION

This report was developed on behalf of SENES Consultants Ltd. for Strata Energy Inc./Peninsula Minerals Ltd. This *Baseline Gamma Radiation Survey and Soil Radium-226 Correlation Report* supports an application for a U.S. Nuclear Regulatory Commission (NRC) license and Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) uranium recovery permit to construct and operate its proposed Ross *in situ* recovery (ISR) project. The NRC source and byproduct materials license is required to recover uranium by ISR extraction techniques under the provisions of Title 10, U.S. Code of Federal Regulations, Part 40 (10 CFR Part 40), “Domestic Licensing of Source Material.” This report is specific to radiation scanning and correlation soil sampling work performed on the site during 2010.

This initial section summarizes site characteristics and the overall study process. Later sections present radiological baseline results for the Ross Project area.

Baseline radiological studies were conducted by Tetra Tech from July 19 through 22, 2010. Tetra Tech used NRC’s Regulatory Guide 4.14, “Radiological Effluent and Environmental Monitoring at Uranium Mills” (NRC, 1980) as guidance to conduct the studies for pre-licensing data collection. Although the Guide does not address certain considerations associated with ISR uranium recovery sites, the NRC and the WDEQ/LQD recommend its use for baseline surveys of ISR sites. Tetra Tech modified aspects of the guidance for this project, to take advantage of technology developed since the Guide was written in the 1970s. However, all applicable guidance elements are covered.

1.1 Site Characteristics

The Ross project site (Figure 1, below) consists of approximately 1,800 acres located in the Lance District (near Oshoto), Crook County, Wyoming (herein referred to as the Site).

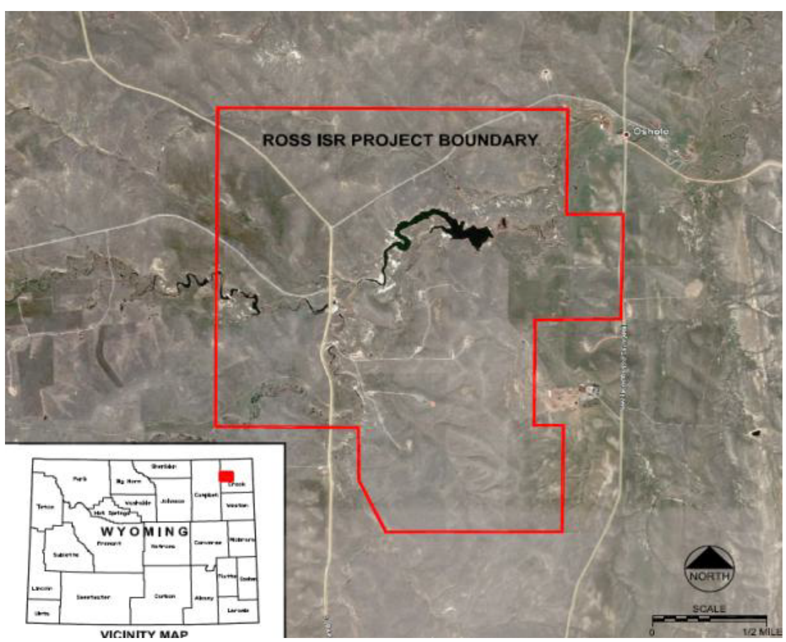

Figure 1. Ross ISR project boundary

Topography at the Site consists primarily of low rolling hills, flat areas, basins and cuts, drainage basins, and ponds. Vegetation includes mixed-grass prairie species, sagebrush, and some wetland-associated grasses. Oshoto Reservoir lies near the center of the Site. Figure 2, below, shows selected photographs of the Site.

Figure 2. Photos from the Ross Site

The dominant land uses at the Site include livestock grazing, hay cultivation, and oil and gas extraction activities.

2.0 BASELINE RADIOLOGICAL INVESTIGATION

2.1 Objectives

The objective of the baseline investigation was to assess existing conditions at the Site, including the spatial distribution of gamma radiation exposure rates, dose rates and soil radionuclide concentrations, prior to the commencement of new ISR uranium extraction activities.

2.2 Survey Methods

The gamma radiation survey is the primary component of the baseline radiological investigation. The survey includes the collection of a large set of gamma radiation exposure rate measurements using a computerized survey system.

Tetra Tech staff performed a field investigation from July 19 through 22, 2010. Figure 1 shows the area to be scanned. Activities included collection of baseline gamma exposure rates, correlation with measured dose rates, and collection of soil samples to develop a correlation between radiation levels and soil radium-226 concentrations.

The gamma radiation scanning survey system uses vehicle- or backpack-mounted equipment to traverse the Site, allowing navigation of rough terrain and sagebrush with minimal environmental impact. Tetra Tech used Yamaha® Rhino ATV and Jeep® Rubicon vehicles for the project. Both vehicles are specially configured to minimize terrain damage during such work. Figure 3 is a photograph of the scanning vehicles utilized for this project.

Figure 3. Project scanning vehicles at Strata headquarters

Both the Jeep® and Rhino® vehicles employ adjustable systems to carry Ludlum 44-10 2-inch sodium iodide (NaI) gamma radiation detectors and paired Global Positioning System (GPS) receivers, set away from the vehicles. The two-inch NaI detectors are coupled to Ludlum 2350-1 rate meters. The permanently paired systems are factory calibrated by Ludlum and report exposure rate (µR/h) as a function of detector count rate. The detector systems are factory calibrated using a Cs-137 source. Because sodium iodide systems exhibit energy-dependent response characteristics (Figure 4), the detectors over-estimate exposure rates from lower-energy radiation generally predominant at an ISR site. Bicron micro-rem detector characteristics are less energy-dependent; such an instrument may be used to develop Site-specific corrections for this characteristic, as discussed later in this report. Simultaneous GPS and gamma radiation exposure rate data are transmitted every second for each system. Data are recorded on netbook PCs using proprietary software (CommReader®, Tetra Tech, 2007). System configuration includes 8-foot spacing between radiation detectors, with each detector positioned roughly 3.5 feet above the ground to avoid obstructions.

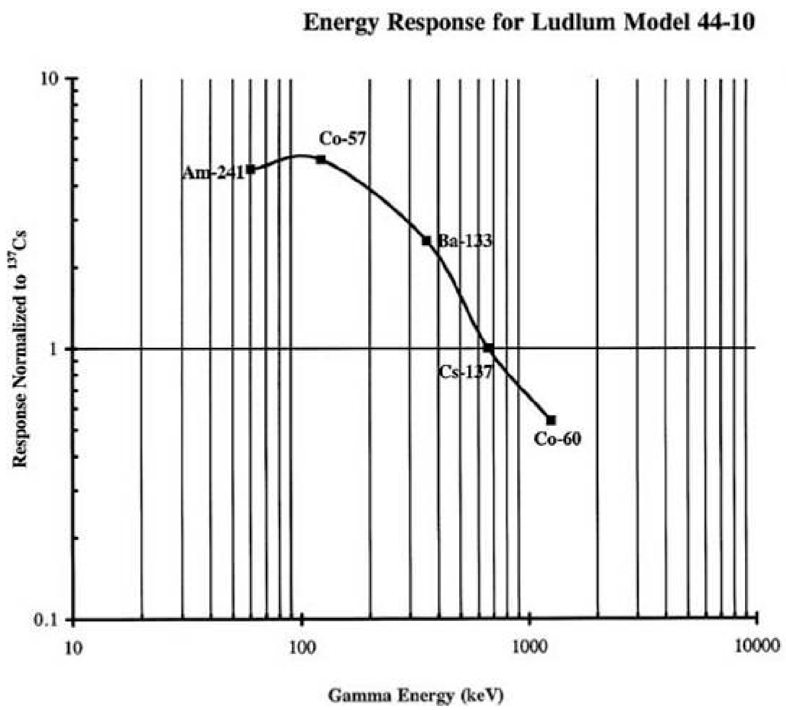

Figure 4. Ludlum model 44-10 NaI detector energy response

The 44-10 gamma detector response to ground-surface above-background radiation sources extends outward roughly 1.5 meter (m), giving each detector an estimated "field of view" roughly 3 m in diameter at ground surface. The track width for each vehicle's two-detector system, therefore, is about 14 feet across. Vehicle scanning speeds ranged between 2 and 10 miles per hour (mph) for this Site, depending on the roughness of the terrain, with an average speed of approximately 5 mph.

One hundred-meter vehicle spacing was the targeted scan coverage, although difficult considerations such as steep terrain and natural obstructions often influenced the actual course maintained by a vehicle. Target tracks were embedded in geographic information system shape files and used to direct real-time vehicle scanning. Near unsafe terrain, vehicles scanned near these planned lines while maintaining safe courses. In one area, landowner interactions precluded scanning as planned. In specific areas of interest defined by the client, 50 m scan vehicle spacing was employed to increase detail.

Data sets were downloaded daily into a project database, backed up and plotted with proprietary mapping software (GammaViewer®, Tetra Tech, 2006). In addition to daily quality control checks of instrument performance, results were reviewed daily using GammaViewer® to help identify problems that may have occurred during data acquisition.

2.3 Gamma Radiation Exposure Rate vs. Dose Rate: Correlation Methods

Because gamma radiation exposure rates as measured by NaI detectors exhibit significant energy response variations, comparing these measurements to those from, for example, a Bicron® micro-rem meter may be useful. Because the Bicron® system's sensitivity to low-level radiation is insufficient for rapid field scanning, onsite cross-correlation against NaI-based measurements were made at 10 areas on the Site. The developed correlation allows the large NaI-detector-based exposure rate data set to be re-mapped using Site-specific Bicron®-based dose rate measurements.

As noted, gamma radiation scan results are useful for proposed ISR mining sites because they can demonstrate differences between pre- and post-operational gamma radiation exposure rate conditions. However, because the same equipment and scanning geometry may not be used during pre- and post-operational surveys, the Bicron correlations may also be useful to normalize the NaI detector data to a second instrument basis. Onsite cross-correlation helps to ensure that future radiation surveys are useful when compared to baseline data. It is also reasonable to expect that specific onsite correlation locations may remain undisturbed during future operations. These locations may provide useful baseline comparisons during eventual facility closure work. Until completion of Site uranium extraction operations, it is not possible to identify which Site correlation locations may remain undisturbed.

To perform NaI/Bicron® cross-correlations, comparison measurements were taken at locations covering a range of exposure rates representative of the Site. These locations were the same as those used for gamma radiation/radium-226 soil correlation plot measurements. At each location, 10 to 15 Bicron® meter readings were averaged. The same areas were scanned at high density using one of the NaI detector systems. Mean NaI exposure rates were plotted against the Bicron® micro-rem meter readings for each location. GPS-based locations of the correlation plots are provided in Section 3 of this report.

2.4 Gamma Radiation/Soil Radionuclide Correlation Methods

Regulatory Guide 4.14 recommends that 41 baseline surface soil samples be collected at 5-cm depths, at 300 m intervals on 8 compass direction radials out to 1.5 kilometers from the center of the milling area (defined as being between the proposed mill structure and tailings pond). Additional 1-m depth sample groups should be collected at the Site's air monitoring stations. This guidance cannot be applied directly to a proposed ISR site (with no tailings pond, and a variety of uranium extraction structures spread over the Site), and therefore requires interpretation. This need, combined with the large size of the typical ISR site and the availability of new technologies including the Global Positioning System and highly portable personal computers, encourages the use of gamma radiation scanning combined with soil radionuclide correlation sampling to define baseline conditions. Rather than attempting to describe the current Site with a small set of point measurements, it is now feasible to map gamma radiation levels over an entire site at many thousands of individual locations, then use correlation soil sampling to map the Site for estimated Ra-226 concentrations.

Correlation soil sampling was conducted via composite sampling over 100 square meter plots (10 m by 10 m). Figure 5, below, shows the composite sampling layout. The sampling locations were selected by inspection of the Site gamma radiation survey data, to cover the measured exposure rate range. Within each plot, nine sub-samples were collected to a soil depth of 15 centimeters, then composited into a single sample representative of the plot. GPS coordinates were taken at the center of each sampling plot. Samples were sent to ALS Laboratory in Fort Collins, Colorado and analyzed for radium-226 via gamma radiation spectrometry after radon daughter equilibration. Samples were dried and homogenized prior to equilibration.

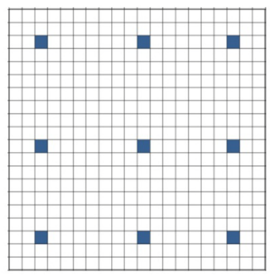

Figure 5. Correlation plot soil extraction locations

Following methods similar to those described in Johnson et al. (2006), each 100 m^2 soil sampling plot was also scanned at high density using a NaI system. One difference from the method described in Johnson et al. (2006) was that the NaI detectors used for this survey were non-shielded (non-collimated). This increases the overall sensitivity of the systems, at the expense of more precise location of small-area radiation sources. The average NaI gamma radiation reading over each plot was calculated and recorded, to pair with the corresponding radium-226 soil concentrations. Results are presented in Section 3 of this report.

2.5 Data Quality Assurance/Quality Control Methods

Radiological characterization projects conducted by Tetra Tech incorporate specific data quality assurance/quality control (QA)/QC protocols. In general, QA includes qualitative factors that provide confidence in the results, while QC involves quantitative evidence that supports the validity of results (data accuracy and precision).

Data quality assurance factors for this project include the following:

- All detectors used for gamma radiation scanning at the Site were calibrated by the manufacturer within the last 12 months.
- Chain-of-custody protocols were followed for soil sampling and contract laboratory radium-226 soil analyses.
- Tetra Tech's Radiological Protection and Measurements staff members possess extensive, pertinent qualifications and experience.

- Tetra Tech's radiological survey methods and results have been published in peer reviewed journals and conference proceedings (Johnson et al., 2006; Meyer et al., 2005a; Meyer et al., 2005b; Whicker et al., 2006).

2.5.1 Quality Control Data Documentation for this Project

Prior to the gamma radiation survey, instrument comparison QC measurements were performed for all NaI detectors potentially used to survey the Site. Sets of individual, background QC measurements were compared under the same counting geometries. Instruments also meeting onsite field test criteria are designated qualified to replace instruments that fail in the field. Data developed using any qualified instrument are interchangeable with data collected using other field-qualified instruments. The distribution of daily background and field strip data may be evaluated via the histogram presented as Figure 6.

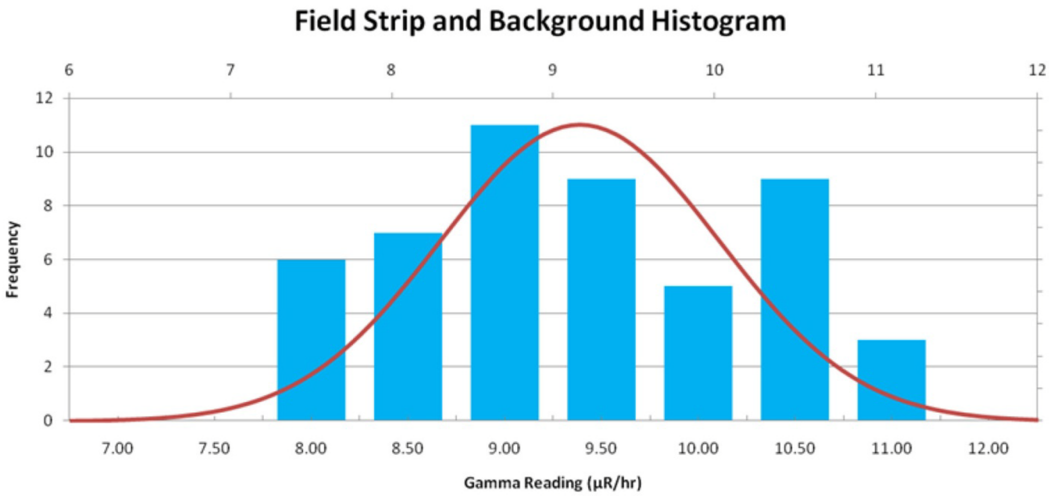

Figure 6. Ross Site Instrument Background Data Distribution

2.5.2 Field Check Results

For normally distributed data, over 99 percent of measurements are expected to fall within ±3 standard deviations from the mean. Background, field strip, and Cs-137 test source (field check source) standard deviation values are re-calculated twice daily; daily plots incorporate results to date. An instrument with a QC result falling outside ±3 standard deviations from the mean of all QC measurements is replaced with a pre-qualified spare detector and sent back to the manufacturer for evaluation, repair and recalibration.

QC measurements, including a background check, a field strip check and a source check, were performed twice daily at the Site for each scanning system in use. These checks were performed outdoors at standard locations. The daily field strip check, during which data are collected along the same 100-meter strip morning and evening, provides an indication of total measurement uncertainty for the systems. The Ludlum 2350 datalogger system employs a calibration factor to internally convert detector counts per minute to exposure rate. The calculated exposure rate, directly proportional to the measured count rate, is transmitted by the data logger to the scanning system portable PC. No record of count rate is retained by the system, but count rate can be calculated using the instrument-specific calibration factor. Factory calibration sheets for each instrument used on the Ross project are provided in Appendix A.

Figures 7 through 9 summarize key QC data acquired during the Ross survey work. All instrument QC results during this project met the acceptability criterion. The daily count rate variations within these limits, seen below, are functions of several likely variables including exact placement of detector systems during daily checks, and variations in barometric pressure. The low detector count rates at very low background gamma exposure rates also contribute to variability. Differences in detector internal characteristics, including minor NaI crystal issues or photomultiplier tube optical interface inconsistencies, may also be responsible for the observed variations in background (low) and check source (high) count rates. For the Ross Site, only the background and field strip QC data are of real interest, given the Site's low radiation levels.

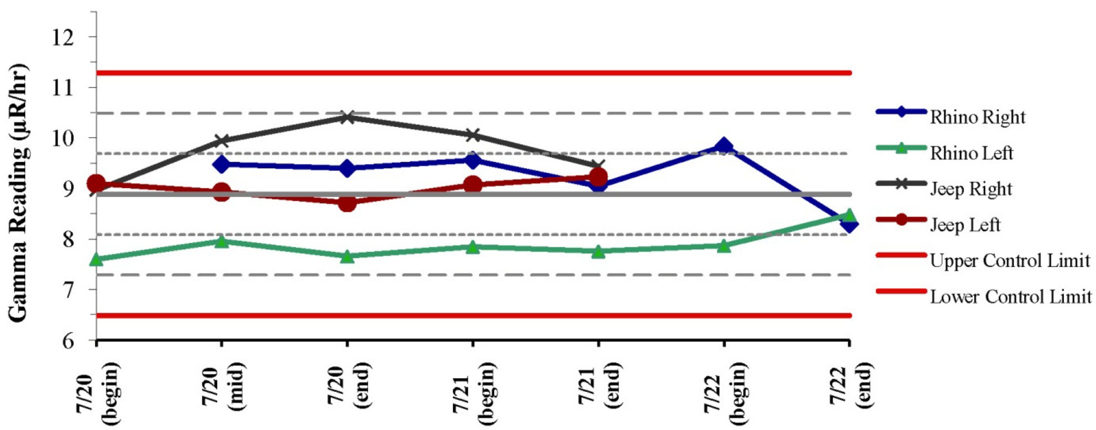

Figure 7. Background exposure rate control chart for scan systems used at Ross; background measurements were collected on site near the main office

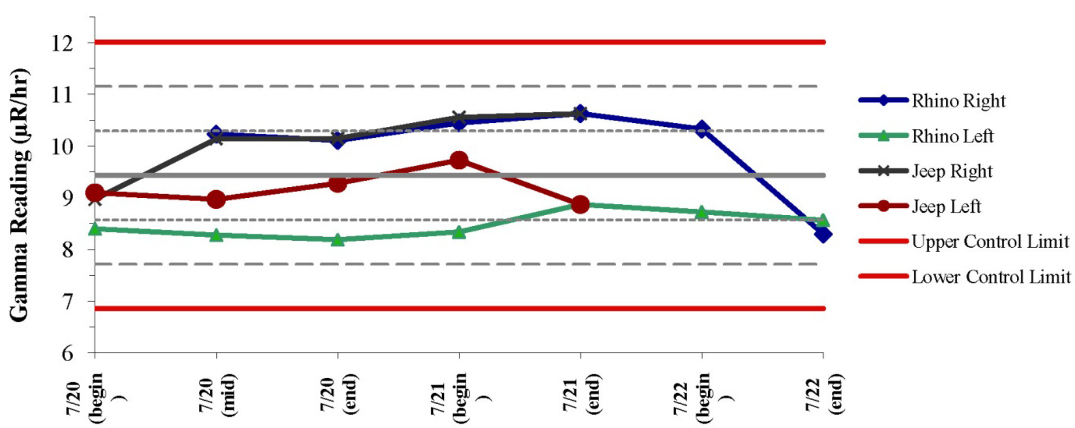

Figure 8. Field strip control chart for scan systems used at Ross; field strip measurements were collected on site near the main office

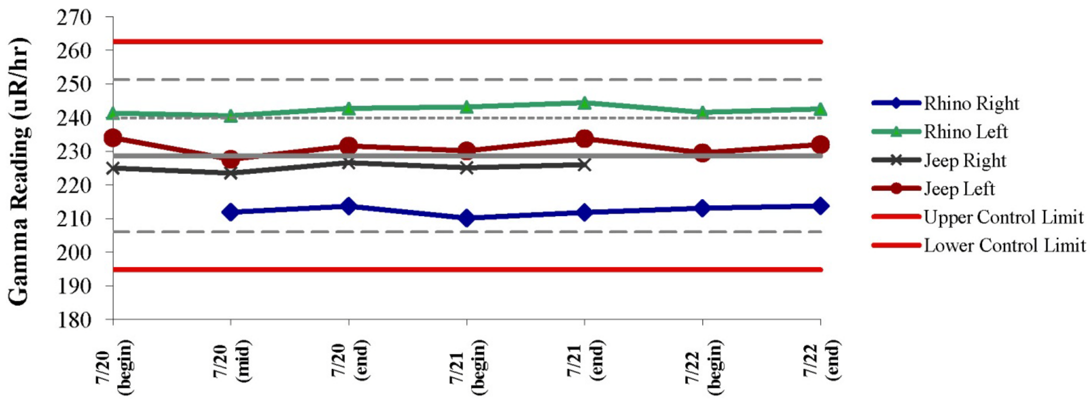

Figure 9. Source check control chart for scan systems used at Ross; source checks were performed with a Cs-137 source at the same location as background checks

3.0 BASELINE RADIOLOGICAL INVESTIGATION RESULTS

3.1 Survey Results

A total of 80,833 valid gamma radiation exposure rate data points, paired with Wide Area Augmentation System (WAAS)-corrected GPS data, were collected over the 1,800-acre Site. Summary statistics and a relative frequency histogram showing the distribution of the gamma radiation exposure data are provided in Figure 10.

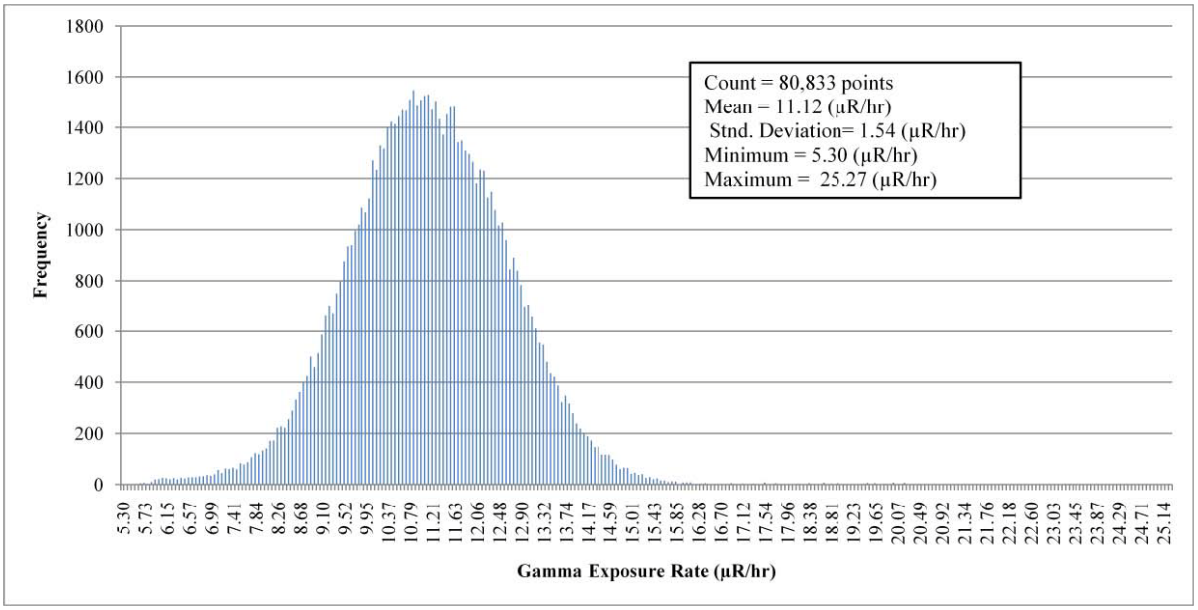

Figure 10. Frequency histogram of gamma radiation exposure data at Ross Site

The histogram shows that the data are normally distributed. The gamma radiation exposure rates on site ranged from 5.3 to 25.3 µR/hr, with a standard deviation of 1.54 µR/hr.

A map of the site's gamma radiation exposure rates is presented as Figure 11. The final data set used to develop this figure has been transmitted to Mr. Ron Stager of SENES, allowing manipulation at will to analyze specific areas of interest. The lowest gamma radiation exposure rates (5 to 6 µR/hr) on the site were observed along D-Road, running near the western property boundary. An important result of this study is that relatively high exposure rates were observed on site on County Road (CR) 193 (Oshoto Road), in the range of 14 to 16 µR/hr.

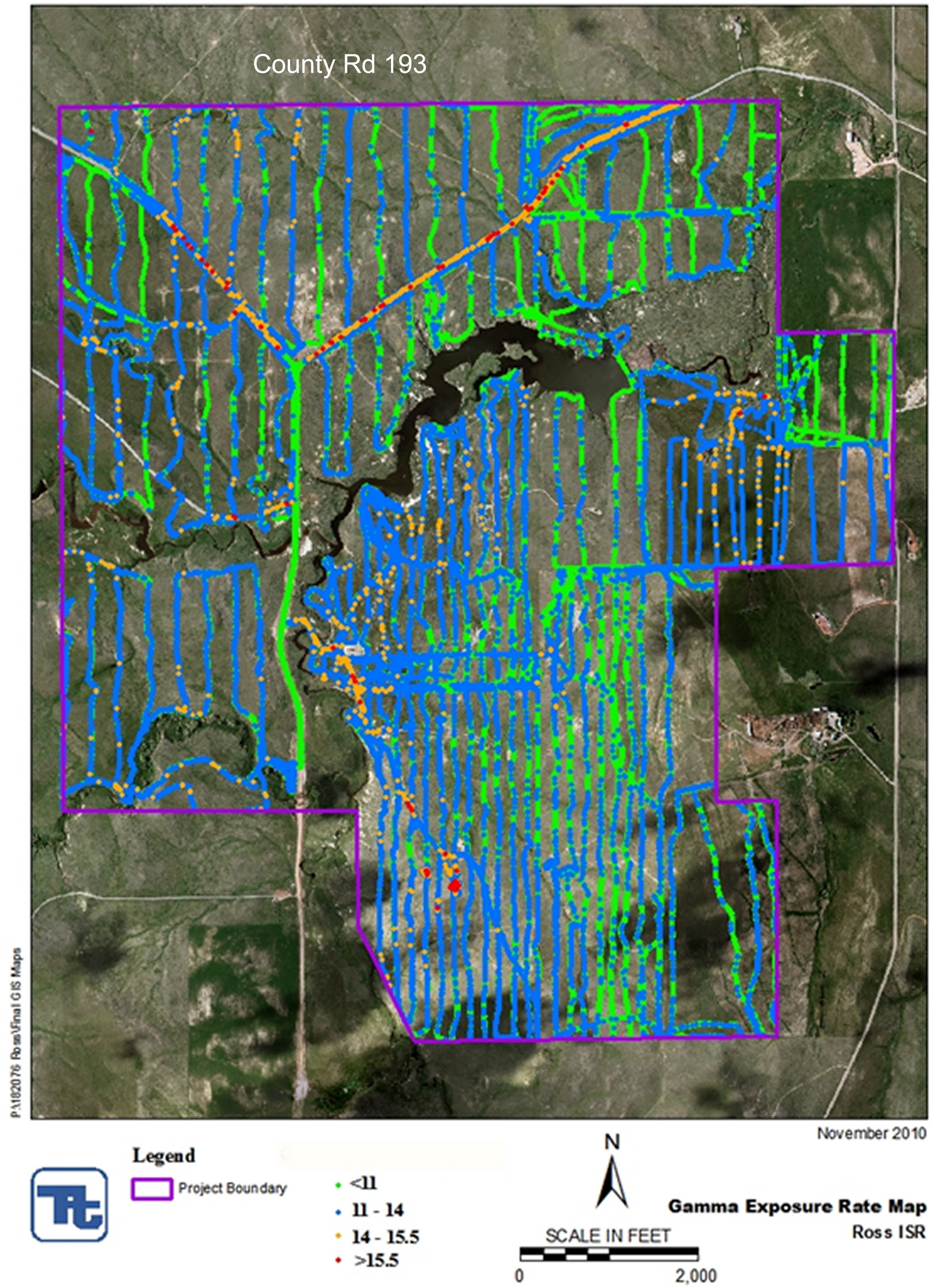

Figure 11. Ross site gamma radiation exposure rates