



Nicholson GeoSolutions, LLC

3433 East Lake Drive
Centennial, CO 80121

April 15, 2015

Mr. Derek Johnson
Linn Energy, LLC
235 Callahan Avenue
Parachute, Colorado 81635

Subject: Proposed Landfarm Sampling Procedures

Dear Derek:

In response to concerns raised by the COGCC regarding sampling of the material currently being landfarmed on the O-36B well pad, the following revised sampling procedures are proposed.

Background

Soil samples are periodically collected from the landfarm on the O-36B well pad, as well as from other landfarms located on Linn well pads in the Garden Gulch, Old Mountain, and Long Ridge areas, Garfield County, Colorado. Samples have been collected twice per year since 2009 using the current procedures that consist of collecting one composite sample of the landfarmed material for analysis and comparison to the COGCC Table 910-1 standards. Each composite consisted of eight subsamples collected at random across the landfarm from depths of at least one foot. Sampling procedures for the pit bottoms were amended in 2014 to include the collection of six discrete soils samples from the walls and floor of the pit.

The existing landfarms on the Linn well pads range in estimated size from a couple hundred cubic yards to over 1,500 cubic yards. The exact volumes present in each landfarm are not known. The concentrations of total petroleum hydrocarbons (TPH), PAHs, and other parameters vary greatly between sites. All of the piles contain some TPH, however, some piles also contain concentrations of PAHs above the standards, while others contain no PAHs. In general, the concentrations of metals are well below the associated standards for all piles (with the exception of arsenic).

Proposed Landfarm Sampling

It is anticipated that several landfarms will be ready for final sampling this year, whereas others, including those with high concentrations of PAHs, may require one to three more years to complete remediation. The following revised sampling procedures are proposed:

- Screening level sampling will continue to be conducted for all piles using the collection of one composite sample. The results of the composite sample will be used to determine when the materials are close to being fully remediated. At that time, more extensive discrete sampling will be conducted to provide statistical confidence that the materials in the landfarm meet the applicable standards.
- For landfarms under 500 yards, eight subsamples will be collected for each composite sample. The number of subsamples in each composite sample will be increased for larger landfarms to 12 subsamples for landfarms between 500 and 1,000 yards and 16 subsamples for landfarms over 1,000 yards.
- The location of each subsample will be recorded using GPS.
- When the concentrations of TPH and/or PAHs are below the standards for the composite sample, more detailed discrete sampling will be conducted. A backhoe will be used to sample deeper levels of the pile where necessary to ensure that representative samples are collected.
- Only those parameters that exceed or may possibly exceed the standards will be analyzed for the final discrete samples. If a parameter is within 20% of the standard it will be considered to be likely to exceed in one or more discrete samples and will be included in the final sampling. As stated above, the concentrations of metals are generally well below the standards. Therefore, for most piles, only TPH and/or PAHs will need to be analyzed for the final sampling event.
- For the final sampling, a backhoe will be used to excavate trenches for sampling. A minimum of four trenches (for landfarms smaller than 500 yards) will be excavated. For piles between 500 and 1,000 yards, six trenches will be excavated, and eight trenches will be excavated for landfarms in excess of 1,000 yards.
- Discrete samples will be collected from each trench for analysis. These samples will be biased toward the most impacted material exposed in the trench, as determined from visual inspection. For landfarms greater than 2 feet in depth, samples will be collected at two depths: near the base of the pile and at the midpoint of depth.
- In summary, the number of discrete final samples proposed is as follows:
 - Less than 500 yards, less than 2 feet deep: 4
 - Less than 500 yards, more than 2 feet deep: 8
 - 500-1,000 yards, less than 2 feet deep: 6
 - 500-1,000 yards, more than 2 feet deep: 12
 - More than 1,000 yards, less than 2 feet deep: 8
 - More than 1,000 yards, more than 2 feet deep: 16

If you have questions regarding the proposed sampling, please contact me.

Sincerely,



David K. Nicholson, P.G.
Nicholson GeoSolutions LLC