Piceance Energy, LLC
2012 Annual Production Monitoring Report for the Furr 16-22B Sentinel Tier II Gas Well Rulison Field, Garfield County, Colorado

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1.0 Introduction

Piceance Energy, LLC (Piceance Energy), a subsidiary of Laramie Energy II, LLC, has developed natural gas resources in the vicinity of Jack's Pocket on the north flank of Battlement Mesa in Garfield County, Colorado. Piceance Energy retained Olsson Associates Inc. (Olsson) to collect natural gas and produced water samples from the Furr Wells to comply with the requirements of the Colorado Oil and Gas Conservation Commission (COGCC) Rulison Sampling and Analysis Plan (RSAP) requirement developed by URS Corporation (URS) for all natural gas wells within a three-mile radius of the former Project Rulison site.

The Piceance Energy natural gas wells discussed in this report are all located within a three-mile radius of the Project Rulison underground nuclear test site conducted in September 1969 by the Atomic Energy Commission, a predecessor agency to the Department of Energy (DOE), and Austral Oil, a private oil company. Project Rulison was a subsurface natural gas stimulation nuclear test designed to produce natural gas from tight gas sands in the Cretaceous age Williams Fork Formation.

In general, the RSAP requires all companies drilling or producing natural gas wells within specified zones and sectors surrounding the former Rulison site to review certain drilling data (gamma ray logs) and to sample certain production media (natural gas and produced water) to document the presence or absence of potential impacts associated with Project Rulison.

The COGCC permitted natural gas wells located within the three mile radius of Project Rulison (including Laramie Energy II wells) are shown on Figure 1. Piceance Energy's Furr Gas wells are shown more specifically on Figure 2. This report presents the 2012 production monitoring results gas and produced water samples collected from the separator for the Piceance Energy Furr 16-22B Tier 2 Sentinel Well on June 19, 2012.

For purposes of classifying the Piceance Energy wells within the context of the current RSAP, the Furr wells are considered Tier II wells located in Sectors 10 and 11. The Furr 16-22B is currently considered to be the closest natural gas well to the former Project Rulison site in Sector 11, since there are no Tier I wells in this sector. The Furr 16-22D has a surface location in Sector 11 and a bottom hole location in Sector 10, but the bottom hole location is near the sector dividing line. The Furr 16-22D well was not sampled in 2011 because there are Tier I wells operated by other companies located within Sector 10.

The baseline sampling results from sampling conducted in November and December 2008, and the subsequent production monitoring sample results conducted in 2009, October 2010, May 2011, November 2011, and June 2012 do not indicate the presence of any Project Rulison related radioactivity in any of the Piceance Energy Tier II wells. A summary table of Laramie Energy II well locations and sampling activities is presented as Table 1. Laboratory analytical results for gas and produced water samples collected from the Furr 16-22B Tier 2 sentinel well are presented in Table 2 through Table 5.

1.1 Tier II Zone Monitoring Requirements

URS Corporation (URS) is working for Noble Energy, EnCana Oil & Gas (USA), Inc., and Williams Production RMT who are also conducting natural gas well drilling operations in the vicinity of Project Rulison. URS has developed a Rulison Sampling Analysis Plan (RSAP), Revision 3 issued in July 2010.

The URS RSAP defines Tier II wells as those gas wells located outside the one-mile radius, but within the three-mile radius of Project Rulison; whereas Tier I wells are defined as those gas wells located within the one-mile radius of Project Rulison. This RSAP has been adopted by the COGCC and outlines the required sampling and analysis for all operators within a three-mile radius of Project Rulison.

According to the July 2010 Revision 3 of the URS RSAP, the Tier II well monitoring includes:

- Drilling Monitoring;
- Production Monitoring; and
- Baseline produced water and natural gas monitoring.

According to the URS RSAP Table 2 - Tier I and II Sampling and Analysis Scheme for Gas Wells within a Three Mile Radius of Project Rulison well production sampling provisions require that Tier II wells, such as the Furr 16-22 B well, are to be sampled and analyzed as follows:

- A one-time sampling and analysis of produced water for the radiological and non-radiological analytes listed in Table 3 and Table 4 of the RSAP. The Tier II wells are to be sampled as soon as possible after hydraulic fracturing but no later than 30 days after the first gas delivery from a new gas well;
- If a Tier II gas well is the closest well in a sector (i.e. no Tier I well), produced water and natural gas will be sampled and analyzed for the radiological

analytes listed in Table 3 quarterly during the first year, semi-annually (twice a year) during the second and third year, and annually thereafter; and

- Further testing is contingent on verified Project Rulison-related radionuclide detection in Tier I zone wells.

The one-time sampling and analysis of radiological and non-radiological results were reported for the Furr wells, including the Furr 16-22B in previous reports which can be found on the COGCC website.

1.2 Piceance Energy Furr 16-22B Tier 2 Gas Well

The Laramie Energy Furr 16-22B well is the closest Tier II well in Sector 11, and the surface location is shown on Figure 2.

Copies of the Isotech Laboratories Inc. (Isotech) laboratory reports for the Furr 16-22B gas sample submitted for tritium (^{3}H) and carbon-14 (^{14}C) analysis and the report for the produced water sample aliquot submitted to Isotech for tritium analysis are included as Appendix A. The analytical results for the produced water sample aliquot analyzed by GEL Laboratory LLC are presented as Appendix B.

Monthly produced water volumes have declined over time in the Furr 16-22B well. Graphs showing the monthly production for the Furr 16-22 B data on the COGCC internet website are included as Appendix C.

1.3 Data Verification and Validation Requirements

Section 9 of the RSAP outlines the data verification and validation requirements. Olsson retained Diane Short & Associates of Lakewood, Colorado to perform the independent data validation on the June 2012 radiochemistry production data for the Furr 16-22B well natural gas and produced water samples. The data verification and validation report is included as Appendix E.

1.4 Radionuclides of Concern and Background Radiation

According to the DOE Rulison Path Forward (June 2009), tritium is the only contaminant of concern. This is consistent with the conclusions of the 1973 AEC Project Manager's report. Tritium, a radioactive isotope of hydrogen (^{3}H), is produced naturally in small quantities in the upper atmosphere and produced in much larger quantities during the detonation of a nuclear device. Tritium is a weak beta emitter and does not emit gamma rays. Since tritium can potentially be entrained within natural gas, and tritium is the most abundant and most mobile nuclide in the Rulison inventory, it is the primary radionuclide of concern. Tritium levels were evaluated in groundwater and surface water in the area

before and after the Project Rulison experiment and were found to be comparable to background concentrations for the 1960s in both sets of samples.

Of the 10,000 curies of tritium estimated to have been produced by the Rulison detonation, 2,824 curies were removed by production testing measurements in the early 1970s. Following correction for decay, the estimated remaining tritium activity in and around the Rulison cavity in Lot 11 was estimated to be between 700 curies and 1,036 curies by late 2009. The DOE Rulison path forward states that even if Tritium were to reach a producing gas well, the risk is low in that there is no reasonable exposure scenario. Water vapor is removed from the gas stream at the well pad where it condenses out and is separated as a waste byproduct. The produced water is separated from the gas stream prior to the gas entering the distribution system. The gas in the distribution system is co-mingled with gas from other wells producing throughout the area.

Laboratories are capable of measuring tritium activity in picocuries per liter (pCi/L), which is one trillionth of a curie. An older unit of measuring tritium activities was the tritium unit. One tritium unit (TU) is equivalent to 3.2 pCi/L. Background tritium concentrations were higher during the 1960s and 1970s due to nuclear testing conducted in the 1950s.

The USGS sample results for a well sample collected in May 1969, approximately four months before Project Rulison was conducted ranged from less than 220 TU (not detected) to a maximum of 618 TU reported. Background activities for tritium were higher at the time due to nuclear weapons testing, so tritium activities in the late 1960s and early 1970s ranged from 700 pCi/L to more than 1,000 pCi/L (Voegeli and Claassen, 1971).

Natural background tritium levels in precipitation today typically range from 10 TU to 20 TU (32 pCi/L to 64 pCi/L). The CDPHE basic groundwater quality standard for tritium is 20,000 pCi/L, referenced as the level of activity that could potentially result in an annual dose of 4 millirems of beta radiation. The U.S. EPA maximum contaminant level (MCL) for tritium is also 20,000 pCi/L.

According to the U.S. Nuclear Regulatory Commission (NRC) *Fact Sheet on Tritium, Radiation Protection Limits, and Drinking Water Standards*, the NRC has evaluated several instances of abnormal releases of liquid tritium from several nuclear power plants, which have resulted in groundwater contamination. The NRC determined, that while these releases were unplanned, that the levels of tritium were within radiation protection limits and did not pose a threat to public health and safety.

Although Project Rulison is regulated by the DOE Legacy Management, and not regulated by the NRC, the NRC Fact Sheet provides a general overview of the health effects of tritium and the technical basis for the regulatory standards that the NRC uses to protect public health and safety, as well as the drinking water standards established by the U.S. EPA. The NRC Fact Sheet on Tritium can be found at http://www.nrc.gov/reading -rm/doc-collections/fact-sheets/tritium-radiation-fs.html.

The fact sheet states the following about tritium:

- Tritium is almost always found as a liquid and primarily enters the body when people eat food or drink water containing tritium or absorb it through their skin. People can also inhale tritium as a gas in the air.
- Once tritium enters the body, it disperses quickly and is uniformly distributed throughout the soft tissues. Half of the tritium is excreted within approximately 10 days after exposure.
- Everyone is exposed to small amounts of tritium every day, because it occurs naturally in the environment and in the foods that we eat. Workers in Federal weapons facilities, medical, biomedical, or university research facilities; or nuclear fuel cycle facilities may receive increased exposures to tritium.
- The type of radiation dose from tritium is the same as from any other type of radiation, including natural background radiation and medical administrations.
- The tritium dose from nuclear power plants is much lower than the exposures attributable to natural background radiation and medical administrations (e.g. x-rays), and exposures from consumer products.

Tritium concentrations have not been detected in natural gas and produced water samples collected from Laramie Energy's Furr 16-22B, Furr 16-22D, or samples collected from the other completed gas wells. Commercial laboratories are capable of measuring very low activities of tritium. Isotech has a method detection limit that can measure down to 10 tritium units, or approximately 32 pCi/L. GEL Laboratories has a method detection limit that measures tritium activities down to approximately 460 pCi/L.

Most of the longer-lived radionuclides produced by the detonation were incorporated into the molten rock that cooled to form a melt glass at the bottom of the cavity. Krypton-85 and Carbon-14 were two other longer-lived radionuclides that were produced by the detonation that could potentially be present in natural

gas. However, gas production testing of the re-entry well in 1970 removed almost all of the krypton-85 and carbon-14 created by the detonation, leaving tritium as the only contaminant of concern. According to the DOE Rulison Path forward, *Table 1 - Radionuclides in Re-entry Well Gas* the estimated remaining krypton-85 was < 10 curies, and the remaining carbon-14 was estimated at < 1 curie.

The re-entry well drilled into the nuclear chimney produced an estimated 455 million standard cubic feet (MMscf) of gas. The only gaseous radionuclides detected (Cooper et al. 2009) were ^{3}H, ^{85}Kr, ^{14}C, ^{37}Ar, ^{39}Ar, and mercury-203 (^{203}Hg). Analysis of gas produced during the tests (Smith 1971a; 1971b) indicates that the concentrations of ^{3}H, ^{85}Kr, and ^{14}C in the natural gas declined steadily throughout production testing, as shown in Figure 6. These results indicate that some of the ^{3}H and the majority of the ^{85}Kr and ^{14}C produced during the explosion at Project Rulison were removed during the gas calibration flaring and production flow testing (AEC 1973), leaving ^{3}H as the most mobile radionuclide that remains in a sufficient quantity to pose a potential health concern if released.

1.5 Rulison Path Forward

In June 2009 the U.S. Department of Energy (DOE), Office of Legacy Management issued a draft report entitled “Rulison Path Forward” which was intended to serve as a guide for discussions with the Colorado State regulators and other interested stakeholders in response to increased drilling for natural gas reserves near the underground nuclear explosion site at Rulison, Colorado. The report outlines the DOE’s recommendation that gas development occur in a conservative, staged drilling approach as the gas production companies move closer toward the COGCC established half-mile radius surrounding the DOE 40-acre institutional control boundary around the Rulison site. Operators wishing to drill within the COGCC half-mile radius would require a full hearing before the commission before the application for permit to drill (APD) could be approved.

Institutional controls are legally enforceable spatial boundaries that limit intrusion at a site to a safe distance to be protective of human health and the environment. The institutional controls at Rulison prohibit drilling below the 6,000 feet depth within the 40-acres known as Lot 11 (northeast quarter of the southwest quarter of Section 25, Township 7 South, Range 95 West, of the Sixth Principal Meridian) surrounding the Project Rulison site. The depth at which the detonation occurred (8,426 feet below ground surface) and the low permeability of the Williams Fork Formation and overlying strata inhibit any potential migration of impacted water

from the cavity. Investigations and remediation of surface contamination were conducted in the 1970s up through 1996 with the cleanup of non-radiological contamination associated with the drilling mud pits and effluent pond that were remediated in 1996, as documented in the Rulison Site Surface Report Published in July 1998. Although no feasible technology exists to remove the subsurface radioactivity contamination from in or around the cavity, the DOE has no evidence that indicates radionuclides from the Rulison site have migrated or ever will migrate beyond the 40-acre institutional control boundary.

Additionally, the COGCC has established a half-mile radius around the Rulison surface ground zero as a buffer zone. Drilling within this half-mile radius would require a hearing with the COGCC and stakeholders before an APD would be approved for drilling a well within this half-mile area.

2.0 Natural Gas and Produced Water Sampling

Piceance Energy authorized sampling of the Furr 16-22B sentinel Tier II well and Olsson performed the 2012 annual sampling of the natural gas and produced water by following the URS RSAP, Revision 3, July 2010. There are no Tier I wells within Sector 10; therefore, the Furr 16-22B is the closest Tier II well in this sector.

2.1 Production Sampling

Well Identification:	Well Surface Location:
• Furr 16-22B	SE ¼, SE ¼, Section 22, T7S, R95W, Sixth P.M.

Olsson personnel sampled natural gas and produced water from the Furr 16-22B well on June 19, 2012 for the radiochemistry parameters listed in Table 3 of the URS RSAP. The samples consisted of natural gas and produced water collected from the Furr 16-22B well separator with the assistance of Piceance Energy's pumper.

2.2 Natural Gas Sample Analysis

The natural gas sample collected from the Furr 16-22B Tier 2 well was submitted to Isotech in Champaign, Illinois for gas compositional analysis including carbon-14 and tritium, a radioactive form of hydrogen. Isotech performed the sample preparation and the tritium analysis, but subcontracted the carbon-14 analysis to Beta Analytic Laboratories in Miami, Florida.

The natural gas sample was collected in an evacuated propane tank provided by Isotech, using a two-stage pressure regulator connected to the separator or the natural gas wellhead. Copies of the laboratory reports from Isotech are included in Appendix A.

Isotech reported the tritium results in tritium units (TU). One TU is equivalent to 3.19 picocuries per liter (pCi/L), and the results, which indicate that tritium was not detected, shown less than the reporting limit of 10 TU are presented in Table 2.

The tritium analysis measures counts above background, and if the concentration is high enough the laboratory can report a finite value with a calculated uncertainty. If the concentration is low relative to the standard deviation of the measurement then the values are reported as "less than" the laboratory reporting limit, meaning that tritium was not detected. Isotech's reporting limit for tritium ranges from about 10 TU to 15 TU.

Beginning in about 1954, atmospheric tritium levels rose in excess of 1,000 TU due to nuclear weapons testing, peaking in 1963. These tritium levels have declined back to natural background levels since then as a result of the ban on nuclear testing. Current natural background levels for tritium in the atmosphere range from 5 TU to 50 TU (15.9 pCi/L to 159.5 pCi/L). The isotopic composition of hydrogen is compared relative to the Vienna Standard Mean Ocean Water (VSMOW) standard.

Isotopic composition of carbon is relative to the Vienna Peedee Belemnite (VPDB) δ^{13} Standard and is based on the carbon isotopes in the shell of a marine fossil. The laboratory detection limit is approximately 1 percent modern carbon (pMC). The results indicate that carbon-14 (^{14}C) is not present in the natural gas and the natural gas has been isolated from sources of modern carbon. According to the DOE Rulison End State Vision (2005) and the Rulison Path Forward (2009) the amount of carbon-14 present in the Rulison Site source term was estimated at 2.2 curies to 2.4 curies. Less than 1 curie is estimated to remain in the Rulison cavity corrected for the carbon-14 activity that was removed during production testing in the early 1970s.

2.3 Produced Water Sample Analysis

Produced water samples were collected from the dump line on the separator unit for the Furr 16-22B gas well on June 19, 2012. The produced water samples were submitted for analysis of radiochemistry parameters as listed in Table 3, as specified for Tier II wells in Table 2 of the URS RSAP. The produced water samples were collected from the separator dump line into a 5-gallon white plastic bucket equipped with a bottom loading valve assembly. The produced water samples were transferred to the laboratory provided sample bottles. Natural gas condensate floating on the produced water in the bucket was disposed in the onsite tank battery sump. This was done to allow inspection of the produced water for sediment and to remove a separate floating layer of natural gas condensate that in the past had presented problems for the laboratory as a result of collecting the samples directly into the plastic bottle ware.

Produced water sample aliquots were submitted to Isotech and to GEL Laboratory for tritium analysis. Additionally produced water samples were submitted to GEL laboratory for other radiochemistry analysis which included gamma spectroscopy, gas flow proportional counting for gross alpha and gross beta, strontium-90 (^{90}Sr), liquid scintillation analysis for Technetium-99 (^{99}Tc), and total uranium.

Previous produced water samples were analyzed for chlorine-36 (^{36}Cl), however, there was significant matrix interference with the analysis due to the high salt content of the produced water. The laboratory could not meet the method detection limit due to high chlorine in the produced water sample. Therefore, the requirement to analyze ^{36}Cl was removed from the 2010 RSAP.

Krypton-85 (^{85}Kr) was a radionuclide originally included in the gamma spectroscopy analysis provided by GEL; however, the analysis produced negative results that had absolute values above the counting error or Minimum Detectable Concentration (MDC) which could potentially indicate a low bias or the data was rejected due to a low abundance. The analysis for ^{85}Kr was removed from the 2010 RSAP due to uncertainty in values that were reported for ^{85}Kr in the produced water samples.

According to the Human Health Fact Sheet for Krypton, August 2005 from Argonne National Laboratory, Krypton is a noble gas that does not generally interact with biological processes. After being taken into the body, a very small amount can dissolve into the bloodstream where it is distributed to the organs and tissues throughout the body. However, the tissue of most concern from exposure to a cloud of ^{85}Kr gas is the skin with most of the dose resulting from the beta particles associated with^{85}Kr radioactive decay. The gamma radiation energy associated with ^{85}Kr is 0.0022 million electron volts (MeV), as compared to the beta particle radiation energy of 0.25 MeV. GEL is not able to analyze the produced water specifically for ^{85}Kr beta.

Although ^{85}Kr could be present in the gas most of the ^{85}Kr produced by Project Rulison was removed during gas flaring conducted in the early 1970s following re-entry drilling into the chimney. Levels of ^{85}Kr measured in the air during the flaring were which were detected at activities above background but significantly below regulated levels. Therefore, ^{85}Kr is not considered to be a radionuclide of concern.

Copies of the laboratory reports from Isotech are included as Appendix B, and a copy of the GEL Laboratories report is included as Appendix C. The laboratory analytical results are discussed in the following section and the results are summarized in Table 1 through Table 5. Copies of the production records for the Furr 16-22B well production data and graphs showing the rates of decline are presented in Appendix D.

3.0 Laboratory Analytical Results

The following sections present the laboratory analytical results for natural gas samples and produced water samples collected from the Furr 16-22B. The laboratory analytical results for the natural gas and produced water samples show that there are no Project Rulison related radionuclides present in the natural gas or produced water samples.

3.1 Natural Gas Sample Results

The natural gas sample results from Isotech are presented in Table 2, for the Furr 16-22B Tier II gas well. Copies of the Isotech laboratory gas sample reports are presented in Appendix A. The Isotech laboratory reports present the compositional analysis reported in mol percent for components in each of the gas samples. The results show that the samples are predominantly composed of methane with lesser concentrations of helium, hydrogen, oxygen, carbon dioxide, nitrogen, ethane, propane, iso-butane, n-butane, iso-pentane, and hexanes. Argon, carbon monoxide, hydrogen sulfide, and ethylene gas were not detected. The gas samples were also analyzed for the radionuclides tritium and carbon-14.

3.1.1 Tritium Results

The tritium in the gas samples collected from the Furr 16-22B in the June 19, 2012 gas sample was reported as < 10 TU. The results were reported as '<' indicates that tritium was not detected above the laboratory method detection limits the sample. One TU is equal to 3.19 pCi/L so this corresponds to a method detection limit of approximately 31.9 pCi/L.

3.1.2 Carbon-14 Results

The carbon-14 results reported for the June 2012 gas sample collected from the Furr 16-22B were reported at 0.7 ± 0.1 percent modern carbon (pMC). This indicates that carbon-14 activities were very low in the gas sample.

3.2 Produced Water Samples - Radiochemistry Results

The following sections present the laboratory analytical results for the produced water sample aliquots collected on June 19, 2012, from the Furr 16-22B gas well that were submitted to Isotech and to GEL for radiochemistry analyses. Copies of the laboratory reports from Isotech and GEL are included as Appendix A and Appendix B, respectively.

Since the DOE has identified tritium as the only radionuclide of concern, produced water sample aliquots were submitted to both Isotech and GEL laboratories for tritium analysis. The tritium results in produced water are summarized in Table 3.

3.2.1 Tritium Results

The Isotech laboratory results for tritium in the produced water sample submitted from the Furr 16-22 B was reported as < 10.0 TU which indicates that tritium was not detected. The minimum detectable activity (MDA) that Isotech is able to achieve for tritium using the direct count method is 10.0 TU. The laboratory method detection limit of 10 TU correlates to approximately 31.9 pCi/L.

The GEL laboratory results for tritium in the June 2012 produced water sample aliquot collected from the Furr 16-22B well also indicate that tritium was not detected. The ^{3}H result reported for the produced water sample was -244 ± 322 pCi/L, and the result is qualified with a "U" which indicates that tritium was not detected. The detection limit was reported at 635 pCi/L and the laboratory reporting limit was 700 pCi/L.

3.2.2 Gross Alpha Radiation Results

The GEL Laboratories, LLC (GEL) laboratory results for gross alpha activities show that alpha radiation was not detected with a result reported as -13 ± 26.2 pCi/L in the June 2012 produced water sample. The GEL laboratory detection and reporting limits for gross alpha radiation were reported as 49.3 pCi/L and 5.0 pCi/L, respectively.

The results for the gross alpha activities in the produced water samples collected from the Furr 16-22B well from 2008 to 2012 are summarized on Table 4 and copies of the laboratory report are presented in Appendix B.

3.2.3 Gross Beta Radiation Results

The GEL laboratory results for the June 2012 produced water sample showed that gross beta activities were detected at 65.3 ± 26.2 pCi/L. The detection limit was reported at 41.7 pCi/L and the reporting limit was 5.0 pCi/L.

The gross beta results in the June 2012 produced water sample are within the expected range of natural background radiation for the area and are likely due to the presence of naturally occurring radionuclides present in sediment entrained in the produced water. The results for the gross beta activities for the 2012 samples are summarized on Table 4 and copies of the laboratory reports are presented in Appendix B.

3.2.4 Strontium-90 and Technetium-99 Results

The produced water samples submitted to GEL Laboratories were analyzed for Strontium-90 (^{90}Sr) and Technetium-99 (^{99}Tc), and the results are qualified with a "U" indicating that these radionuclides were not detected in the Furr 16-22B well June 2012 produced water sample. The laboratory results show that Strontium-^{90}Sr results were reported at 0.0446 ± 0.908 pCi/L, and a detection limit of 1.26 pCi/L and a reporting limit of 2.0 pCi/L.

The Technetium-99 (^{99}Tc) results indicated that ^{99}Tc was not detected in the June 2012 produced water sample. The results for ^{99}Tc activities in the produced water sample were reported as 0.00 ± 17.3 pCi/L with a detection limit of 30.3 pCi/L and a reporting limit of 50.0 pCi/L. The ^{90}Sr and ^{99}Tc results are summarized on Table 4 and copies of the laboratory reports are presented in Appendix B.

3.2.5 Gamma-Emitting Radionuclide Results

The results for the gamma-emitting radionuclides analysis show that gamma activities were not detected for 44 of the radionuclides reported. This is indicated with a letter 'U' in the results of the laboratory report and also in the first row of Table 5 and Table 5A. Copies of the laboratory reports for gamma spectroscopy results are included in Appendix B.

The naturally occurring radionuclide Bismuth-214 was reported at 18.6 ± 9.11 pCi/L and a laboratory detection limit of 8.88 pCi/L. Other naturally occurring radionuclides including Lead-212, Lead-214, Thorium-234 and Uranium-238 were qualified as "UI" indicating uncertain identification in the June 2012 produced water sample.

3.3 Data Verification and Validation

The following section presents a summary of the data verification and validation analysis of the Isotech laboratory reports (18536 and18529) and GEL laboratory reports (306472) for samples collected on June 19, 2012. Diane Short and Associates reviewed and validated the Isotech and GEL laboratory data and prepared three separate reports. These reports are included as Appendix D.

The first report was prepared for the tritium analyses performed by both labs, and other analyses performed by GEL including gas flow proportional counting (GFPC) for gross alpha/beta, and Sr-90, and liquid scintillation counting (LSC) for Tc-99 in water. The second report was for validation of the inductively coupled plasma mass spectrometry (ICP/MS) total uranium results and the third was for validation of gamma spectroscopy analyses performed by GEL.

3.3.1 Isotech Gas Analysis and Isotech and GEL Tritium Results

The following sections present the findings of the data verification and validation reports prepared by Diane Short & Associates for tritium and carbon-14 in natural gas samples and tritium and other radionuclides in produced water samples. Telephone logs were not included; however, relevant email correspondence with the laboratories was provided to Diane Short & Associates. No contractual violations with the laboratories exist.

Natural Gas Samples

Isotech performed analysis of tritium and carbon-14 on natural gas samples from the Furr 16-22B and a duplicate sample, 'Furr 16-22X'. Isotech subcontracted Beta Analytic in Miami, Florida to analyze the carbon-14 in the gas samples. Beta Analytic did not provide the raw data so it was not possible for Diane Short & Associates to evaluate the carbon-14 results. The information was requested of Beta Analytic, but it was not provided. Copies of the chain-of-custody from Isotech to Beta Analytic were provided.

The reports from Isotech included count data, standard data, and detailed calculations, but do not contain the same level of information as the GEL laboratory report QA/QC package.

Produced Water Samples

A produced water sample was collected and submitted to Isotech for tritium analysis. An aliquot of the produced water sample was also submitted to GEL for tritium analysis in addition to other radiochemistry analyses. The GEL data packages include standard certifications, quench curves, spectrum plots, and raw data. The Isotech packages do not contain this level of information, but do include count data, standard data, and detailed calculations.

The GEL results are reported in pCi/L and the Isotech results are reported in TU (tritium units). For water, 1 TU is 3.231 pCi/L. After conversion, the GEL results have significantly higher reporting limits, but they are consistent with the results from Isotech in that ^{3}H was not detected. Uncertainties were provided in the laboratory reports. However, the raw data provides the uncertainties and the review was conducted using that information.

The analytical report or data sheets were present and complete for the requested analyses, contract holding times were met, and the samples were properly preserved, or applicable preservative was used. In the overall assessment of the

data, Diane Short & Associates concluded that the data are considered fully usable for project purposes with consideration of the qualifications or comments.

3.3.2 GEL Results for Gas Flow Proportional Counting/Liquid Scintillation

The GEL Laboratories data package included raw data, and a level IV review was conducted. The data are considered fully useable for project purposes with consideration of the qualifications or comments.

3.3.3 GEL Results for Total Uranium

The GEL Laboratories data package included the raw data for ICP/MS total uranium. The data are considered fully useable for project purpose. No qualifiers have been added.

3.3.4 GEL Results for Gamma Spectroscopy

The GEL Laboratories data are considered fully useable for project purposes with consideration of the qualifications or comments. The GEL Laboratories data package included raw data, and at client request a level IV review was conducted. The method used is EPA 901.1.

Samples were collected in pre-preserved bottles but due to the buffering capacity of the produced water, the samples were received at the laboratory at a pH of > 2 standard pH units. The laboratory added preservative to bring the sample pH into the acceptance range prior to conducting the analysis. This is permissible per the regulations and has no impact on the results. No qualifiers were added.

Data Exception Reports (DER) are generated by the laboratory to document any procedural anomalies that may deviate from referenced SOP or contractual documents. Diane Short & Associates noted that some analytes did not meet the Data Exception Report (DER) limit. The results were reported as 'Non-detect' and are acceptable since they are reported as 'non-detects' in both the parent and duplicate samples. All are 'non-detects' and no qualifiers are applied.

The laboratory flagged a number of results with "UI" or uncertain identification to indicate that they suffer from some type of detection issue. These results are qualified as JQ to indicate that they could be biased. It should be noted that these results were reported for the naturally occurring radionuclides ^{234}Th, ^{238}U and daughter products ^{212}Pb and ^{214}Pb were the results were reported as '0.00 ± Uncertainty.'

4.0 Summary

The results of the June 19, 2012 sampling of Piceance Energy's closest Tier II well, the Furr 16-22B, indicate that radiation related to Project Rulison not was detected. The surface locations for the Furr 16-22B in Section 22, Township 7S, Range 95 West of the Sixth Principal Meridian, but were directionally drilled. The Furr 16-22B is the closest Tier II well in RSAP Sectors 11 and is located within the three-mile radius of Project Rulison. The locations of the wells are shown on Figure 1 and Figure 2.

Isotech indicated that the LP tanks containing the gas samples and the produced water samples submitted for tritium analysis arrived in good condition. GEL indicated that the produced water sample arrived in good condition and met the sample receipt criteria.

GEL laboratories indicated that the produced water sample was received with a pH equal to 4 standard pH units and that nitric acid was added to the sample at the laboratory to bring it into the proper pH. The produced water sample was collected into a laboratory-provided bottle that contained nitric acid; however, the buffering capacity of the salts within the produced water neutralized the acid. Olsson gave the laboratory permission to add more nitric acid to the sample to bring it to the proper pH for the method.

Both Isotech and GEL reported that ^{3}H was not detected at or above laboratory method detection limits. Tritium was not detected in the gas sample or duplicate gas sample, and tritum was not detected in the produced water sample analyzed by Isotech or the produced water sample aliquot analyzed by GEL.

Carbon-14 (^{14}C) was also identified in the Project Rulison estimated inventory as a radionuclide that potentially could be present in natural gas. The Isotech analytical results for the natural gas samples collected from the Furr 16-22B and Furr 16-22B well gas sample show that carbon-14 was detected at 0.7 pMC ± 0.1 pMC; however, this value is at or slightly above the laboratory method detection limit and within the range of natural background. The laboratory results for the duplicate sample, Furr 16-22X, indicated that carbon-14 was not detected above the laboratory reporting limits (< 0.2 pMC). The laboratory results suggest the sample has been isolated from modern carbon sources.

Gross alpha activities were not detected in the Furr 16-22B produced water sample, but gross beta activities were reported at 65.3 ± 26.2 pCi/L. This is likely related to low levels of naturally occurring radionuclides present in the sample.

The laboratory analytical results indicate that ^{90}Sr, and ^{99}Tc, results were reported as "U" meaning that they were 'not detected' in the produced water samples. The results for total uranium using ICP/MS show that uranium was detected at low levels in all of the samples. The laboratory report also indicates that uranium was detected in the method blank at a concentration that suggests that all of the uranium results reported for the samples should be "Not-detected."

The laboratory analytical results for gas flow proportional counting of Chlorine-36 (^{36}Cl) and Strontium-90 (^{90}Sr) show that these radionuclides were not detected in the produced water sample. Laboratory results for liquid scintillation counting of Technetium-99 indicate that ^{99}Tc was not detected in the produced water sample.

Results of the data verification and validation indicate that the data is usable for the purposes of this project with consideration of the qualifications and comments mentioned in the laboratory report, and those of the independent data reviewer. The laboratory data was reviewed by Diane Short and Associates. The data validation report is included as Appendix D.

5.0 References

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TABLES AND FIGURES

TABLE 1

Piceance Energy - Furr Lease Rulison Tier II Wells
Jacks Pocket - Garfield County Colorado
Sampling History

		Surface Location												
WELL	**PAD**	**QTR/QTR**	**SEC**	**TWP**	**RNG**	**Elevation**	**TOTAL DEPTH (FT.)**	**FIRST PRODUCTION DATE**	**4th Quarter 2008**	**1st Quarter 2009**	**2nd Quarter 2009**	**3rd Quarter 2009**	**4th Quarter 2009**	**October 2010**
Furr A11-15B	Furr A-11	NE SW	15	7S	95W	6,428	7,690	9/27/08	B (11/13/08)	N/A	N/A	N/A	N/A	N/A
Furr A11-15D	Furr A-11	NE SW	15	7S	95W	6,428	7,684	10/7/08	B (11/13/08)	N/A	N/A	N/A	N/A	N/A
Furr Hagen 6-22B	F-1	SW NE	22	7S	95W	6,657	8,225	10/28/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr Hagen 6-22D	F-1	SW NE	22	7S	95W	6,657	8,225	10/10/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 7-22B	F-1	SW NE	22	7S	95W	6,695	8,077	10/20/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 7-22D	F-1	SW NE	22	7S	95W	6,696	8,110	10/21/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 10-22B	F-1	SW NE	22	7S	95W	6,698	8,130	10/25/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 9-22B	F-2	SE SE	22	7S	95W	7,119	8,820	11/3/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 9-22D	F-2	SE SE	22	7S	95W	7,117	8,720	11/11/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 16-22B	F-2	SE SE	22	7S	95W	7,118	8,520	11/3/08	B (12/17/08)	P (NS)	P (6/24/09)	P (10/01/09)	P (12/16/09)	P (10/07/10)
Furr 16-22D	F-2	SE SE	22	7S	95W	7,115	8,540	11/11/08	B (12/17/08)	P (4/14/09)	P (6/24/09) D	P (10/01/09)	P (12/16/09)	P (10/07/10)
Furr 10-22D	F-3	SW SE	22	7S	95W	7,130	8,606	11/17/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 15-22B	F-3	SW SE	22	7S	95W	7,131	9,172	11/17/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 15-22D	F-3	SW SE	22	7S	95W	7,123	8,476	11/17/08	B (12/17/08)	N/A	N/A	N/A	N/A	N/A
Furr 22-09A	F-4	SW SE	22	7S	95W	6,984	8,388	7/7/10	N/A	N/A	N/A	N/A	N/A	B (10/07/10)
Furr 22-09C	F-4	SW SE	22	7S	95W	6,987	8,235	7/1/10	N/A	N/A	N/A	N/A	N/A	B (10/07/10)
Furr 22-10A	F-4	SW SE	22	7S	95W	6,991	8,460	7/29/10	N/A	N/A	N/A	N/A	N/A	B (10/07/10)
Furr 22-10C	F-4	SW SE	22	7S	95W	6,985	8,306	7/16/10	N/A	N/A	N/A	N/A	N/A	B (10/07/10)
Furr 22-15A	F-4	SW SE	22	7S	95W	6,988	8,177	7/13/10	N/A	N/A	N/A	N/A	N/A	B (10/07/10)
Furr 22-15C	F-4	SW SE	22	7S	95W	6,991	8,115	7/13/10	N/A	N/A	N/A	N/A	N/A	B (10/07/10)
Furr 22-16A	F-4	SW SE	22	7S	95W	6,985	8,255	7/6/10	N/A	N/A	N/A	N/A	N/A	B (10/07/10)

Note: Rows shaded in gray indicate wells that were sampled during 2012 - Furr 16-22B which is the closest Tier 2 well in the sector.
NS - Not Sampled
N/A - Not Applicable
B - Baseline Sampling (One Time)
P - Production Sampling of the Closest Tier II Wells

TABLE 2

FURR 16-22B GAS SAMPLE DATA
Rulison Area Well Monitoring
Furr 16-22B Tier 2 Well
Natural Gas Samples - Piceance Energy - Rulison Field, Garfield County, Colorado

Well Name/ No.	Sample Source	Latitude/	Longitude	Isotech Job No.	Isotech Lab No.	Sample Name	Date Sampled	CO %	H_2S %	He %	H_2 %	Ar %	O_2 %	CO_2 %	N_2 %	C_1 %	C_2 %	C_2H_4 %	C_3 %	iC_4 %	nC_4 %	iC_5 %	nC_5 %	C_6+ %	$^{14}C_1$ pMC	Std. Dev. (±)	Tritium TU	Std. Dev. (±)	Total BTU calc	Specific Gravity calc
Furr 16-22B	Separator	39.41662	-107.97507	10796	152400	Furr 16-22B	12/17/2008	ND	ND	0.0029	0.0036	ND	ND	2.97	0.029	89.26	5.12	ND	1.50	0.335	0.322	0.139	0.0981	0.220	< 0.4	N/A	< 10.0	N/A	1076	0.642
				N/A	N/A	Furr 16-22B	4/14/2009	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
				11610	165099	Furr 16-22B	6/24/2009	ND	ND	0.0033	0.0029	ND	0.0324	3.00	0.17	89.76	4.86	ND	1.35	0.278	0.248	0.0969	0.0640	0.133	< 0.5	N/A	< 10.0	N/A	1061	0.634
				12055	172338	Furr 16-22B	10/1/2009	ND	ND	0.0030	0.0026	NA	0.006*	3.58	0.056	88.86	5.04	ND	1.47	0.340	0.292	0.0830	0.0574	0.211	< 0.4	N/A	< 10.0	NA	1065	0.644
				12367	176955	Furr 16-22B	12/16/2009	ND	ND	0.0029	0.0027	ND	0.027	3.60	0.14	89.25	4.97	ND	1.19	0.253	0.190	0.102	0.0773	0.192	< 0.5	N/A	< 10.0	N/A	1055	0.640
				13942	196345	Furr 16-22B	10/7/2010	ND	ND	0.0023	0.0026	ND	ND	2.93	0.078	89.77	4.92	ND	1.33	0.289	0.269	0.116	0.0813	0.214	1.2	0.1	< 10.0	N/A	1068	0.636
				15352	211832	Furr 16-22B	5/23/2011	ND	ND	ND	ND	NA	0.037*	2.96	0.22	89.36	4.91	ND	1.48	0.314	0.285	0.106	0.0792	0.251	< 0.7	N/A	< 10.0	N/A	1070	0.640
				16947	228828	Furr 16-22B	11/29/2011	ND	NA	NA	ND	NA	0.021*	2.64	0.15	90.1	4.65	ND	1.36	0.300	0.294	0.130	0.0935	0.257	< 0.2	N/A	< 10.6	N/A	1072	0.635
				18536	252646	Furr 16-22B	6/19/2012	ND	NA	NA	ND	NA	0.13*	2.87	0.50	89.25	4.75	ND	1.46	0.315	0.313	0.130	0.0906	0.193	0.7	0.1	< 10.0	N/A	1065	0.640

Note: Shaded rows present the analytical data for the samples collected in 2012 which are discussed in this report. The table presents the data as compared to the results for samples collected previously from the Furr 16-22B.

$^{14}C_1$ - Carbon 14 — Carbon-14 (14C) Detection Limit is 1.0 pMC. Isotopic composition of carbon is relative to the Vienna Peedee Belemnite (VPDB).

Tritium — Tritium (^3H) Detection Limit 10.0 TU. Isotopic composition of hydrogen is relative to Vienna Standard Mean Ocean Water (VSMOW).

Std. Dev./ (±) — Standard Deviation (±) Uncertainty

Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol.% Chemical analysis based on standards accurate to within 2%.
* Isotech did not analyze Argon separately, but reported combined results for Oxygen and Argon

Acronyms:
pMC - Percent Modern Carbon.
TU - Tritium Units (One TU is equivalent to 3.19 pCi/L of water)
< - Not Detected (ND) (Above Laboratory Method Detection Limit)
Std. Dev. (±) - Standard Deviation
BTU - British Thermal Units (cu. Ft. dry calcuated at 60°F and 14.7 psia)
calc - calculated value
N/A - not applicable
NA - not analyzed
ND - not detected
NS - not sampled (Furr 16-22B was shut in on 04/14/09)

Gas Component:
CO - Carbon Monoxide
H_2S - Hydrogen Sulfide
He - Helium
H_2 - Hydrogen
Ar - Argon
O_2 - Oxygen
CO_2 - Carbon Dioxide
N_2 - Nitrogen
C_1 - Methane
C_2 - Ethane
C_2H_4 - Ethylene
C_3 - Propane
iC_4 - Iso-Butane
nC_4 - N-Butane
iC_5 - Iso-Pentane
nC_5 - n-Pentane
C_6+ - Hexanes+

TABLE 3

TRITIUM ANALYTICAL RESULTS FOR PRODUCED WATER SAMPLES
Furr 16-22B Tier II Well Production Data
Piceance Energy, Rulison Field, Garfield County, Colorado

Well Name/Number	Sample Source	Latitude	Longitude	Qtr/ Qtr	Section	Township	Range	P.M.	Sample ID	Lab Job No.	Lab Number	Date Sampled	Time Sampled	Laboratory	Tritium (TU)	Tritium (pCi/L) calculated	Tritium Result Qualifier	Tritium (pCi/L)	Uncertainty (pCi/L)
Furr 16-22B	Separator	39.41669	-107.97507	SE SE	22	7S	95W	6th	Furr 16-22B	10797	152413	12/17/2008	12:54	ISO	< 10.8	< 34.5	N/A	N/A	N/A
Furr 16-22B										NS	NS	4/14/2009	NS	ISO	NS	NS	NS	NS	NS
Furr 16-22B										11602	165053	6/24/2009	11:55	ISO	< 13.7	< 43.7	N/A	N/A	N/A
Furr 16-22B										12055	172338	10/1/2009	11:30	ISO	< 10.0	< 31.9	N/A	N/A	N/A
Furr 16-22B										12373	177011	12/16/2009	13:00	ISO	< 10.0	< 31.9	N/A	N/A	N/A
Furr 16-22B										13942	196345	10/7/2010	15:00	ISO	< 10.0	< 31.9	N/A	N/A	N/A
Furr 16-22B										15352	211837	5/23/2011	12:45	ISO	< 10.0	< 31.9			
Furr 16-22B										CORD00100	278674001	5/23/2011	12:45	GEL			U	-153	± 240
Furr 16-22B										16948	228829	11/29/2011	12:25	ISO	< 10.0	< 31.9			
Furr 16-22B										OLSS00111	291078001	11/29/2011	12:25	GEL			U	-19.6	± 322
Furr 16-22B										18529	252333	6/19/2012	13:30	ISO	< 10.0	< 31.9			
Furr 16-22B										OLSS00111	306572001	6/19/2012	13:30	GEL			U	-244	±322

Note: Shaded rows present the results for samples collected in 2012 as presented in this report. The table also presents the results from previous sampling events for the Furr 16-22B Tier 2 Gas Well.

Tritium (^3H) Detection Limit 10.0 TU. Isotopic composition of hydrogen is relative to Vienna Standard Mean Ocean Water (VSMOW).
Modern background levels for Tritium range from 100 pCi/L to 300 pCi/L

Abbreviations:

ISO - Isotech Laboratories, Inc. of Champaign, IL
GEL - GEL Laboratories LLC Charleston, SC
TU - Tritium Units (One TU is equivalent to 3.19 pCi/L of water) Note: Isotech reported the tritium results in TU and Olsson Associates converted to equivalent picocuries per liter.
pCi/L - picocuries per liter

< - Result is less than the method detection limit
U - Analyte was not detected above GEL Laboratory's Minimum Detectable Activity (MDA)
NS - Not Sampled (Furr 16-22B was shut-in and the separator did not yield sufficient water volume to enable sample collection in April 14, 2009.)
N/A - Not Applicable (Produced water samples were not analyzed for tritium by GEL Laboratories from 2008 to 2010.)

TABLE 4

Radiochemistry Gas Flow Proportional Counting/Liquid Scintillation Analysis/Total Uranium for Produced Water Samples
Furr 16-22B Tier II Well
Piceance Energy - Rulison Field, Garfield County, Colorado

WELL NAME/ Sample ID	Sample Source	Latitude/	Longitude	QTR/ QTR	Section	Township	Range	P.M.	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Laboratory	GFPC Gross Alpha	Result ± Uncertainty (pCi/L)	Detection Limit (pCi/L)	GFPC Gross Beta	Result ± Uncertainty (pCi/L)	Detection Limit (pCi/L)	GFPC Chlorine-36	Result ± Uncertainty (pCi/L)	Detection Limit (pCi/L)	GFPC Strontium-90	Result ± Uncertainty (pCi/L)	Detection Limit (pCi/L)	LSA Technetium-99	Result (pCi/L)	Detection Limit (pCi/L)	Total Uranium	Result ± Uncertainty (µg/L)	Detection Limit (µg/L)
Furr 16-22B	Separator	39.41669	-107.97507	SW SE	22	7S	95W	6th	16-22B	12/17/2008	12:54	GEL	U	5.88 ± 16.8	30.4	U	15.9 ± 27.6	46.8	U	-98.4 ± 152	271	U	0.817 ± 0.781	1.27	U	8.00 ± 17.5	29.7		0.548 ± 0.116	0.267
										4/14/2009	NS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
										6/24/2009	11:55	GEL		21.8 ± 13.3	20.2		31.9 ± 11.6	18.1	U	125 ± 136	229	U	-0.98 ± 0.861	1.93	U	-8.79 ± 13.0	22.8	U	-0.0389 ± 0.0302	0.0766
										10/1/2009	11:30	GEL		26.0 ± 11.5	15.9	U	11.1 ± 10.9	18.3	U	37.1 ± 135	234	U	0.103 ± 0.785	1.44	U	4.47 ± 27.2	46.8	U	0.0175 ± 0.0161	0.928
										12/16/2009	13:00	GEL	U	-1.05 ± 12.9	23.4		20.1 ± 11.2	18.2	U	75.7 ± 244	416	U	-0.136 ± 0.947	1.85	U	8.67 ± 18.2	31.1	U	0.0057 ± 0.000823	0.66
										10/7/2010	15:00	GEL	U	24.0 ± 24.7	39.8	U	29.8 ± 23.4	38.8	U	28.8 ± 53.5	95.0	U	-13.1 ± 10.3	19.7	U	-20.2 ± 20.6	36.1	0.25		0.25 MDL
									Furr 16-22B	5/23/2011	12:45	GEL		39.4 ± 19.9	27.1	U	23.8 ± 25.9	43.4	U	243 ± 218	363.0	U	-0.785 ± 0.605	1.26	U	11.0 ± 25.1	43.2	U	0.067	0.067
									Furr 16-22B	11/29/2011	11:15	GEL	U	30.7 ± 35.1	58.9		42.7 ± 23.6	37.9	NA	NA		U	-0.00829 ± 0.677	1.27	U	-5.88 ± 21.2	37.6	U	0.067	0.067
									Furr 16-22B	6/19/2012	13:30	GEL	U	-13 ± 26.2	49.3		65.3 ± 26.2	41.7	NA	NA		U	0.0446 ± 0.908	1.65	U	0.00 ± 17.3	30.3	U	0.067	0.067
										April 2009 GEL Reporting Limits:					5			5			100			2			50			1
										June 2009 GEL Reporting Limits:					5			5			100			2			50			1
										October 2009 GEL Reporting Limits:					5			5			100			2			50			1
										December 2009 GEL Reporting Limits:					5			5			100			2			50			1
										October 2010 GEL Reporting Limits:					5			5			100			2			50			1
										May 2011 GEL Reporting Limits:					5			5			100			2			50			1
										November 2011 GEL Reporting Limits:					5			5						2			50			1
										June 2012 GEL Reporting Limits:					5			5						2			50			1

Table presents the 2011 (shaded) and previous laboratory analytical results for produced water samples collected from the Furr 16-22B Tier 2 Well.
The Furr 16-22B well was shut-in and was not sampled during the April 14, 2009 sampling event.

Abbreviations:

pCi/L - picocuries per liter (activity in parts per trillion)
µg/L - micrograms per liter (concentration in parts per billion)
Qualifier
U - Result is less than the sample specific Minimum Detectable Concentration (MDC) or Minimum Detectable Activity (MDA), Method Detection Limit (MDL), Limits of Detection (LOD), total propogated uncertainty (TPU), or laboratory reporting limit (RL).
NS - Not Sampled (Furr 16-22B well was shut-in during the 4/14/09 sampling event and was not sampled)
NA - Not Analyzed
N/A - Not Applicable
GFPC - Gas Flow Proportional Counting
LSA - Liquid Scintillation Analysis

TABLE 5

GAMMA SPECTROSCOPY RESULTS FOR PRODUCED WATER SAMPLES
Furr 16-22B Tier II Well - 2011 Sample Results
Piceance Energy - Rulison Field, Garfield County, Colorado

WELL NAME/No.	Sample Collection Point	Latitude/ Longitude	QTR/QTR	SEC	TWP	RNG	P.M.	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Gamma Emitting Radionuclides	Ac-228 Result (pCi/L)	Am-241 Result (pCi/L)	Sb-124 Result (pCi/L)	Sb-125 Result (pCi/L)	Ba-133 Result (pCi/L)	Ba-140 Result (pCi/L)	Be-7 Result (pCi/L)	Bi-212 Result (pCi/L)	Bi-214 Result (pCi/L)	Ce-139 Result (pCi/L)	Ce-141 Result (pCi/L)	Ce-144 Result (pCi/L)	Cs-134 Result (pCi/L)	Cs-136 Result (pCi/L)	Cs-137 Result (pCi/L)	Cr-51 Result (pCi/L)	Co-56 Result (pCi/L)	Co-57 Result (pCi/L)	Co-58 Result (pCi/L)	Co-60 Result (pCi/L)	Eu-152 Result (pCi/L)	Eu-154 Result (pCi/L)	Eu-155 Result (pCi/L)	Ir-192 Result (pCi/L)	Fe-59 Result (pCi/L)	Kr-85 Result (pCi/L)
Furr 16-22B	Separator	39.4167 -107.97507	SE SE	22	7S	95W	6th	16-22B	12/17/2008	12:54	Qualifier	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	3.91	0.459	1.22	-1.04	-0.923	16.6	-4.13	-3.67	4.67	0.590	-0.838	-6.11	1.19	11.4	0.177	6.72	-0.858	0.0899	-3.17	0.181	-5.17	-0.406	-7.3	-0.128	-2.27	-1760
											Uncertainty (±)	15.7	11.6	4.83	5.60	3.29	25.1	20.1	15.9	5.23	2.03	4.96	14.1	2.41	9.13	2.18	31.3	2.24	1.78	2.47	2.39	5.88	5.55	7.85	2.49	4.80	638
											MDC	15.6	17.3	8.58	9.02	4.63	44.1	34.0	25.9	8.60	3.55	8.54	22.2	4.20	17.6	3.41	52.8	3.52	2.90	3.47	3.54	9.11	9.20	11.3	4.13	7.62	928
									4/14/2009	NS	Qualifier	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
											Result																										
											Uncertainty (±)																										
											MDC																										
									6/24/2009	11:55	Qualifier	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	11.6	-3.81	-0.143	3.25	-7.26	-19.4	-14.5	18.6	8.74	-2.29	1.36	-7.7	3.36	0.283	-0.784	-1.22	0.205	1.31	-1.14	-1.26	2.57	-0.359	-2.93	0.868	-1.35	-911
											Uncertainty (±)	14.6	16.1	4.82	6.38	3.46	13.0	20.0	19.0	8.05	2.40	4.54	16.7	2.62	3.86	2.31	22.8	2.15	2.17	2.01	2.30	6.37	5.55	9.14	2.31	4.48	737
											MDC	19.8	27.2	8.14	11.2	4.99	15.9	31.7	34.2	10.9	3.81	7.43	27.3	5.04	6.58	3.69	39.0	3.72	3.73	3.22	3.47	11.2	9.15	15.2	4.05	7.24	1160
									10/1/2009	11:30	Qualifier	UI	U	U	U	U	U	U	U	19.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	0.00	7.60	1.67	5.38	0.881	0.820	-0.107	7.16		-1.97	1.36	3.43	0.565	-0.589	0.433	-5.4	0.180	2.67	-0.88	1.32	-3.69	0.355	0.0159	0.730	1.38	706
											Uncertainty (±)	12.1	14.4	4.83	5.26	2.73	8.67	17.2	15.6	8.70	1.95	3.61	14.1	2.50	3.40	2.13	18.3	1.97	1.73	2.03	2.24	5.97	6.25	7.73	1.94	4.12	496
											MDC	17.2	23.2	8.57	9.33	4.36	14.3	28.4	27.2	6.38	3.09	6.10	23.8	4.26	5.73	3.67	30.6	3.30	3.07	3.27	3.98	9.75	10.6	13.1	3.36	7.24	797
									12/16/2009	13:00	Qualifier		U	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	12.4	3.01	-0.276	-1.17	0.825	2.26	-3.22	-0.0361	12.3	-0.159	-0.501	-2.45	1.16	0.966	-0.412	-5.03	-0.197	0.640	-0.0759	1.11	-0.0193	0.770	-0.174	-0.188	-0.358	-2250
											Uncertainty (±)	7.70	5.28	2.19	2.49	1.29	7.16	8.77	12.5	4.96	0.905	2.03	6.24	1.06	2.61	0.943	10.7	0.964	0.814	0.943	0.961	2.52	2.61	3.32	0.991	2.12	341
											MDC	5.02	7.91	3.67	4.17	2.01	12.2	14.6	12.9	2.97	1.52	3.42	10.5	1.91	4.49	1.52	16.9	1.64	1.42	1.62	1.71	4.37	4.42	5.72	1.59	3.52	370
									10/7/2010	15:00	Qualifier	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UI
											Result	8.69	-22.2	1.89	5.65	-8.23	145	159	-136	-17.7	1.29	-61.4	-7.01	-4.73	11.7	3.15	-173	-3.52	4.48	-10.3	5.15	-17.4	-13.5	-22.2	2.34	17.2	0.00
											Uncertainty (±)	66.8	76.8	38.6	35.9	19.5	245	149	249	48.0	12.2	43.6	77.1	17.2	89	13.4	236	17.4	9.55	16.3	13.6	42.10	39.2	41.3	17.2	38.2	4010
											MDC	101	127	65.8	59.6	31.3	432	278	350	60.8	21.2	55.9	125	27.50	153	23.1	371	27.80	16.1	24.5	24.0	67.6	61.4	65.6	29.0	68.4	7590
								Furr 16-22B	5/23/2011	12:45	Qualifier	UI	U	U	U	U	U	U	U	UI	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	0.0	-5.86	-1.56	-3.0	-0.857	-1.63	-0.133	19.7	0.00	0.234	3.06	-4.06	0.603	4.49	-0.59	-1.84	0.245	1.78	-1.29	-0.0342	-2.41	-4.18	-0.686	0.53	1.04	-1480
											Uncertainty (±)	12.6	10.6	4.97	4.77	2.43	15.9	16.1	25.9	6.61	1.74	3.87	11.7	2.04	4.68	1.75	19.9	1.73	1.55	2.37	1.90	4.99	5.64	6.41	1.93	4.25	584
											MDC	10.1	14.9	7.91	7.68	3.56	24.5	27.1	45.7	9.16	2.91	6.54	19.5	3.61	8.86	2.76	34.4	3.01	2.79	3.41	3.10	8.32	8.17	11.0	3.19	7.33	811
								Furr 16-22B	11/29/2011	11:15	Qualifier	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA
											Result	10.7	1.64	-0.411	-4.73	0.757	-3.9	14.4	22.3	14.3	-3.2	-0.791	4.61	1.36	8.95	-1.58	31.3	-3.09	0.453	0.934	1.08	-4.03	-1.77	3.00	-0.47	4.67	NA
											Uncertainty (±)	23.4	5.21	7.99	8.53	4.12	16.3	34.1	41.0	9.73	2.68	7.79	17.1	3.50	14.8	4.77	44.2	3.75	2.29	3.84	3.19	9.12	8.74	7.98	3.44	8.70	NA
											MDC	29.7	9.16	16.1	14.9	6.89	30.4	65.2	83.5	17.3	4.37	13.4	31.5	6.95	31.2	9.48	86.6	6.28	4.21	7.52	6.63	16.3	16.7	15.0	6.35	17.7	NA
								Furr 16-22B	6/19/2012	13:30	Qualifier	U	U	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA
											Result	13.6	11.7	-0.389	-3.6	0.231	-0.235	-0.0167	18.7	18.6	-1.84	5.08	0.583	1.20	-3.62	0.947	1.35	-1.61	-1.75	-1.36	0.21	-3.57	-4.19	6.31	-1.47	-3.14	NA
											Uncertainty (±)	9.96	13.3	4.98	6.77	3.32	4.09	18.9	35.9	9.11	2.24	4.51	15.8	2.47	5.46	2.20	24.0	2.79	2.17	2.57	1.90	8.0	5.37	9.10	2.61	4.92	NA
											MDC	21.6	21.8	10.1	11.4	5.28	8.28	36.2	71.2	8.88	3.81	8.69	28.8	5.02	9.09	4.45	43.3	4.80	3.74	4.47	4.02	13.6	9.09	17.2	4.41	8.74	NA

Table presents gamma spectroscopy analytical results for the Furr 16-22B Tier 2 well - 2012 data is shaded in gray.
Samples were all analyzed by GEL Laboratories, LLC in Charleston, SC

GEL Laboratories
May 2011 Reporting Limit: 5
November 2011 Reporting Limit: 10

Four Rows:
1) Qualifier — The laboratory data qualifers are designated by one or two letters to provide information about the reported results.
2) Result — Results are the level of activity reported for the individual produced water sample.
3) Uncertainty (±) — The margin of error, or range of activity, when added to the result.
4) MDC — The laboratory minimum detectable concentration (MDC) for the analytical method.
If the result is less than the reporting limits the radionuclide is reported as 'not detected' (U).

Bismuth-214 was detected at 18.6 ± 9.11 pCi/L. Bismuth-214 is a naturally occurring radionuclide, and this low detection is related to naturally occurring radiation.

The qualifiers used in the laboratory reports are listed below:
U - Result is less than the sample specific Minimum Detectable Concentration (MDC) or Minimum Detectable Activity (MDA),
Method Detection Limit (MDL), Limits of Detection (LOD), total propogated uncertainty (TPU), or laboratory reporting limit (RL).
UI - Gamma Spectroscopy Uncertain Identification
NS - Not Sampled (Furr 16-22B was shut-in on April 14, 2009 and was not sampled)
NA - Not Analyzed
N/A - Not Applicable

Note: Values shown in blue represent a detection or an uncertain identification. The gamma emitting radionuclides that were detected are naturally occurring potassium-40 (^{40}K), lead-212 (^{212}Pb), lead-214 (^{214}Pb), and bismuth-214 (^{214}Bi) in a few of the samples.

TABLE 5

GAMMA SPECTROSCOPY RESULTS FOR PRODUCED WATER SAMPLES
Furr 16-22B and Furr 16-22D Tier II Wells
Piceance Energy - Rulison Field, Garfield County, Colorado

(Table Continued)

WELL NAME/No.	Sample Collection Point	Latitude/ Longitude	QTR/QTR	SEC	TWP	RNG	P.M.	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Gamma Emitting Radionuclides	Pb-210 Result (pCi/L)	Pb-212 Result (pCi/L)	Pb-214 Result (pCi/L)	Mn-54 Result (pCi/L)	Hg-203 Result (pCi/L)	Nd-147 Result (pCi/L)	Np-239 Result (pCi/L)	Nb-94 Result (pCi/L)	Nb-95 Result (pCi/L)	K-40 Result (pCi/L)	Pm-144 Result (pCi/L)	Pm-146 Result (pCi/L)	Ra-228 Result (pCi/L)	Ru-106 Result (pCi/L)	Ag-110m Result (pCi/L)	Na-22 Result (pCi/L)	Tl-208 Result (pCi/L)	Th-230 Result (pCi/L)	Th-234 Result (pCi/L)	Sn-113 Result (pCi/L)	U-235 Result (pCi/L)	U-238 Result (pCi/L)	Y-88 Result (pCi/L)	Zn-65 Result (pCi/L)	Zr-95 Result (pCi/L)
Furr 16-22B	Separator	39.4167 -107.97507	SE SE	22	7S	95W	6th	16-22B	12/17/2008	12:54	Qualifier	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	31.4	-3.14	3.30	0.333	2.44	-16.7	3.69	0.251	-1.36	27.2	-0.00461	0.616	3.91	13.6	-1.81	-0.146	-0.272	802	134	-0.35	-19.5	134	-0.221	-0.378	1.72
											Uncertainty (±)	347	4.74	6.03	1.84	2.87	58.5	12.9	1.97	3.27	34.0	2.04	2.29	15.7	17.4	1.83	2.00	2.57	5220	128	2.97	16.4	128	2.39	4.28	4.19
											MDC	517	6.62	8.61	3.10	5.04	97.2	21.3	3.33	5.21	27.3	3.42	4.02	15.6	31.4	2.75	3.31	3.92	1300	140	4.84	23.2	140	3.97	7.16	7.26
									4/14/2009	NS	Qualifier	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
											Result																										
											Uncertainty (±)																										
											MDC																										
									6/24/2009	11:55	Qualifier	U	U	U	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	-65.5	2.59	9.75	1.64	-0.51	4.09	-15.1	1.99	0.896	95.1	-1.01	-0.297	11.6	2.67	0.102	-0.128	2.41	-268	-77	-3.23	21.8	-77	-2.46	-5.41	1.65
											Uncertainty (±)	522	5.83	6.13	2.15	2.55	24.1	17.2	2.05	2.55	26.1	2.28	2.95	14.6	20.1	2.15	1.98	3.01	2030	149	2.72	18.7	149	2.80	5.73	4.08
											MDC	799	8.40	10.2	3.95	4.35	41.0	27.8	3.72	4.34	41.7	3.60	4.95	19.8	33.8	3.58	3.26	4.34	1890	231	4.19	28.8	231	4.02	8.22	7.01
									10/1/2009	11:30	Qualifier	U	U	UI	U	U	U	U	U	U	UI	U	U	UI	U	U	U	U	U	U	U	U	U	U	U
											Result	-146	2.04	0.00	-1.93	-0.682	4.96	5.50	0.473	0.997	0.00	-0.564	-1.13	0.00	8.42	-0.728	0.126	2.39	54.1	138	-1.04	-3.37	138	0.699	-2.95	-0.199
											Uncertainty (±)	524	5.33	6.03	2.05	2.07	17.6	13.5	1.71	2.16	47.8	1.83	2.58	12.1	18.2	1.92	2.23	3.76	942	178	2.42	18.5	178	2.12	4.23	3.42
											MDC	722	6.66	9.37	3.13	3.49	29.4	23.2	2.96	3.75	29.6	3.02	4.14	17.2	32.1	3.17	3.77	3.33	1520	178	3.94	25.9	178	3.75	6.71	5.72
									12/16/2009	13:00	Qualifier	U	UI	UI	U	U	U	U	U	U	48.5	U	U	12.4	U	U	U	U	UI	U	U	U	U	U	U	U
											Result	-172	0.00	0.00	0.443	-0.224	11.2	1.87	0.193	0.981		-0.677	0.207		2.6	0.270	0.303	0.0956	0.00	27.3	-0.0612	-8.49	27.3	0.188	1.48	0.127
											Uncertainty (±)	211	3.18	4.51	0.897	1.18	16.3	5.83	0.866	1.73	19.8	0.884	1.12	7.70	8.36	0.855	0.936	1.76	5940	78.1	1.21	10.9	78.1	1.11	2.25	1.82
											MDC	210	3.5	4.64	1.58	1.91	28.1	10.1	1.44	2.08	16.6	1.39	1.92	5.02	14.1	1.44	1.59	1.91	574	63.5	2.08	11.6	63.5	1.89	3.45	2.99
									10/7/2010	15:00	Qualifier	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
											Result	950	18.6	13.9	5.54	-15.5	-289	106	0.197	4.68	-192	9.01	-10.8	8.69	-45.6	4.71	-4.94	22.90	-2050	-487	6.36	-7.89	-487	12.8	-13.4	-2.32
											Uncertainty (±)	2720	57.2	32.4	13.9	19.3	555	104	11.9	20.2	155	14.4	16.5	66.8	127	13.2	13.9	25.60	4830	823	20.1	94.7	823	17.8	31.1	30.5
											MDC	4720	66.4	55.3	23.9	30.5	890	180	19.8	34.2	232	25.5	26.8	101	206	22.9	21.8	40.1	7900	1220	33.9	134	1220	33.8	49.3	50.2
								Furr 16-22B	5/23/2011	12:45	Qualifier	U	U	UI	U	U	U	U	U	U	U	U	U	U	UI	U	U	U	U	UI	U	U	U	U	U
											Result	-53.1	4.68	0.00	0.137	-0.999	-2.06	1.06	-1.3	-2.06	16.8	0.273	0.391	0.00	1.21	-0.423	-1.48	-0.765	0.00	83.6	-0.467	6.55	83.6	0.526	-0.15	0.279
											Uncertainty (±)	273	4.82	7.33	1.79	2.25	27.3	15.8	1.76	2.64	29.9	1.87	2.12	12.6	16.3	1.63	1.99	2.32	885	132	2.24	14.3	132	2.20	4.26	3.54
											MDC	405	7.03	6.43	3.08	3.55	45.4	27.2	2.64	3.22	49.6	3.11	3.65	10.1	27.2	2.61	2.88	3.61	1050	169	3.77	21.0	169	3.83	6.40	6.15
								Furr 16-22B	11/29/2011	11:15	Qualifier	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	U	U	U	U	U	U
											Result	-36.7	1.63	7.4	1.01	2.58	22.8	-20.8	0.5	-0.42	41.1	-0.663	-0.472	10.7	17.3	-8.22	-0.694	-2.69	NA	-29.9	-0.336	5.99	-29.9	-0.162	-5.33	0.921
											Uncertainty (±)	61.9	6.17	11.4	3.16	4.21	104	21.3	2.79	4.12	65.9	2.91	3.51	23.4	29.3	3.88	3.09	3.77	NA	69.1	4.48	18.9	69.1	3.7	7.03	6.32
											MDC	109	10.4	15.6	6.22	7.71	196	36.5	5.42	7.69	55.0	5.41	6.40	29.7	56.9	5.60	5.89	6.32	NA	120	7.85	33.3	120	7.67	11.4	12.4
								Furr 16-22B	6/19/2012	13:30	Qualifier	U	UI	UI	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	UI	U	U	UI	U	U
											Result	-126	0.00	0.00	-1.94	1.71	16.1	-14.5	-0.0112	-1.22	58.4	-0.523	0.964	13.6	0.434	-0.448	-1.42	0.509	NA	0.00	-0.0475	-13.8	0.00	-0.0542	-2.12	-1.03
											Uncertainty (±)	211	9.15	9.35	2.20	2.50	28.9	23.0	2.22	2.86	45.2	2.19	2.75	9.96	21.0	2.13	1.90	3.02	NA	216	3.09	18.2	216	2.86	4.72	4.66
											MDC	348	9.13	14.5	3.56	4.77	58.1	40.1	4.18	5.03	61.4	4.00	5.42	21.6	39.8	3.94	3.26	5.38	NA	180	5.55	29.9	180	5.69	8.67	8.52

Samples were all analyzed by GEL Laboratories, LLC in Charleston, SC

Four Rows:
1) Qualifier — The laboratory data qualifers are designated by one or two letters to provide information about the reported results.
2) Result — Results are the level of activity reported for the individual produced water sample.
3) Uncertainty (±) — The margin of error, or range of activity, when added to the result.
4) MDC — The laboratory minimum detectable concentration (MDC) for the analytical method.
If the result is less than the reporting limits the radionuclide is reported as 'not detected' (U).
Radionuclides Pb-212, Pb-214, Th-234, and U-238 are naturally occurring radionuclides that were reported as "UI - Uncertain Identification" due to a low bias.

The qualifiers used in the laboratory reports are listed below:
U - Result is less than the sample specific Minimum Detectable Concentration (MDC) or Minimum Detectable Activity (MDA),
Method Detection Limit (MDL), Limits of Detection (LOD), total propogated uncertainty (TPU), or laboratory reporting limit (RL).
UI - Gamma Spectroscopy Uncertain Identification
NS - Not Sampled (Furr 16-22B was shut-in on April 14, 2009 and was not sampled)
NA - Not Analyzed
N/A - Not Applicable

Note: Values shown in blue represent a detection. The gamma emitting radionuclides that were detected are naturally occurring potassium-40 (^{40}K), lead-212 (^{212}Pb), lead-214 (^{214}Pb), and bismuth-214 (^{214}Bi) in a few of the samples.

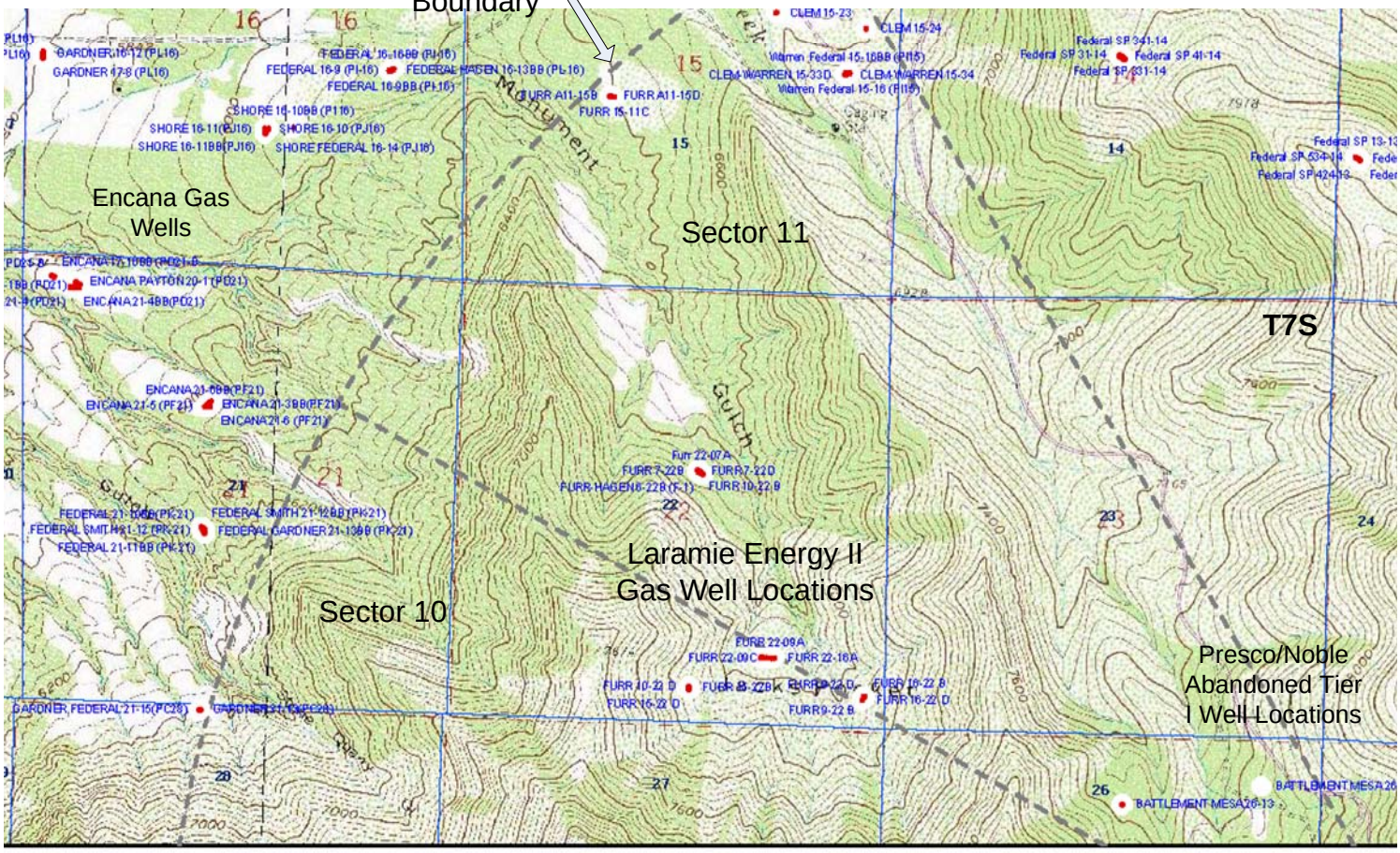
Base Map – USGS Rulison 7.5-minute Quadrangle adapted from the COGCC GIS Database Website

R 95 W

Project Rulison 3-Mile Radius Boundary

Encana Gas Wells

Sector 12



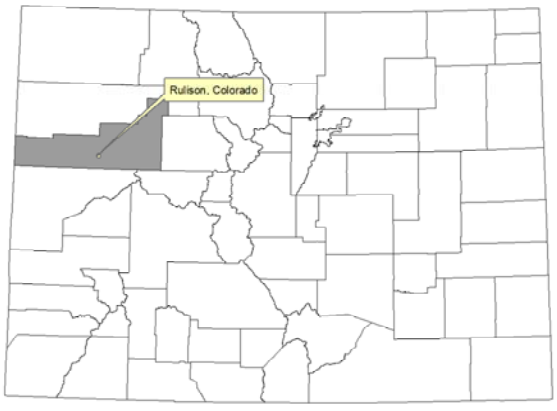
SCALE 1 : 24,042

2,000 0 2,000 4,000 6,000

FEET

N

Colorado Index Map



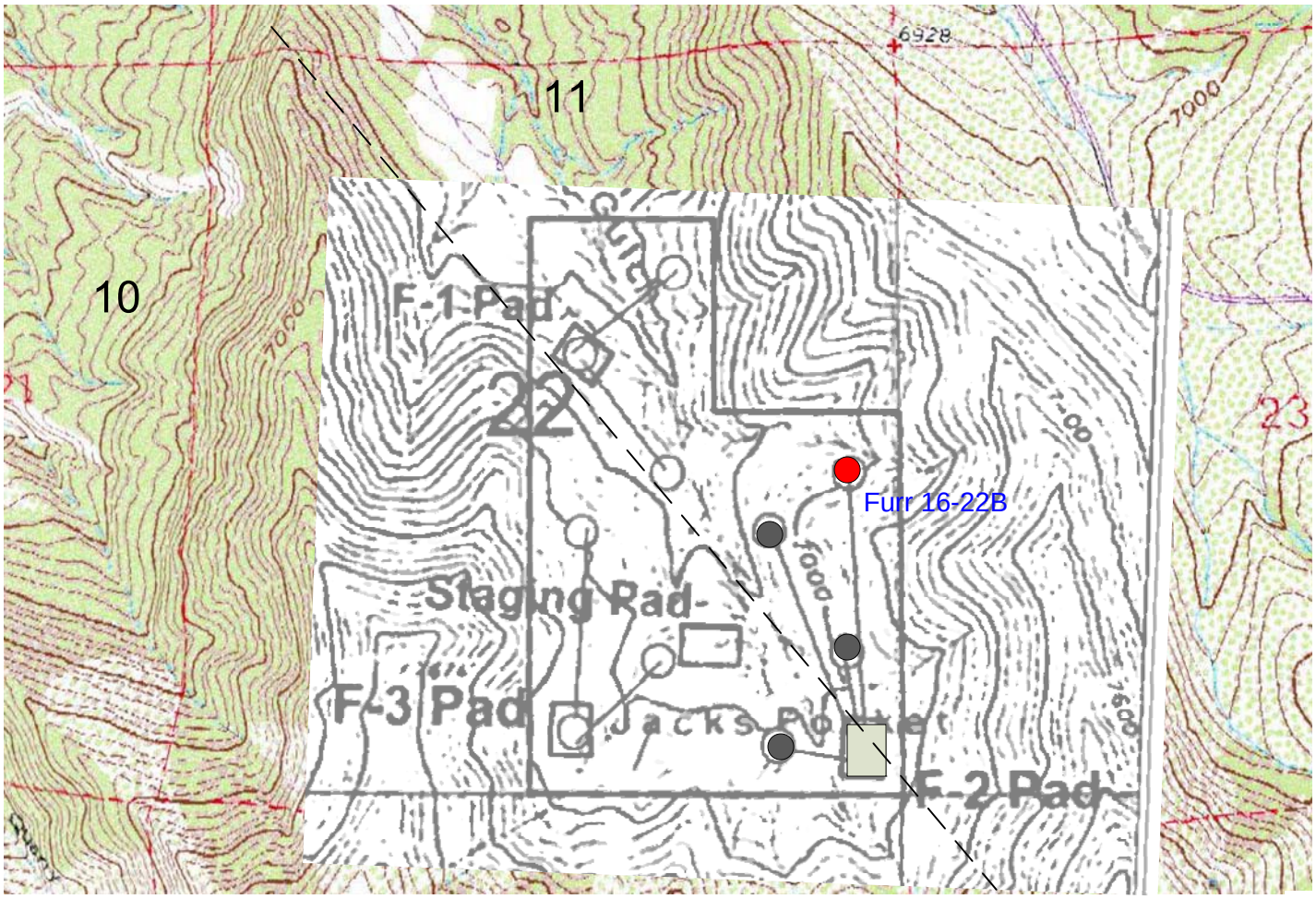
LEGEND:

Furr 16-22B — Gas Well Location and Name

Project Rulison 3-Mile Radius Boundary and Sector Dividing Lines

PROJECT NO: 008-2362	Laramie Energy II Gas Well Locations Project Rulison Area	OLSSON ASSOCIATES 4690 Table Mountain Dr. #200 Golden, CO 80403 TEL 303.237.2072 FAX 303.237-2659	FIGURE 1
DRAWN BY: JWH			
DATE: 08/22/11			

Base Map – USGS Rulison 7.5-minute Quadrangle and Well Pads and Well Locations adapted from the COGCC GIS Database Website



LEGEND:

F-2 Pad Location
(Furr 16-22B Surface Location)

Furr 16-22B — Gas Well Bottom Hole Location
Location (990 FSL and 330 FEL)

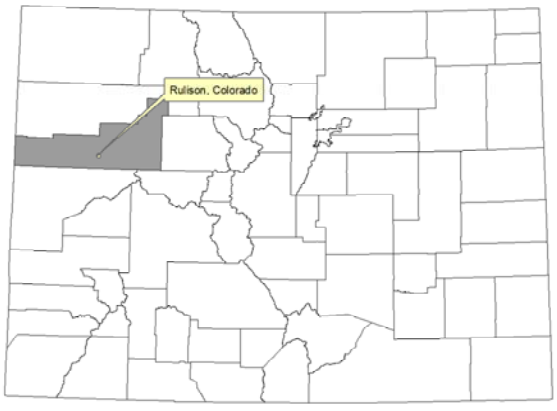
Bottom Hole Locations for other F-2 Pad Wells

Bottom Hole Locations for other LEII Tier II Wells

11
10
Approximate Location of Dividing Line Between Sector 10 and Sector 11

N

Colorado Index Map



PROJECT NO: 011-2843	Laramie Energy II Furr 16-22B Tier II Sentinel Gas Well Locations Project Rulison Area	OLSSON ASSOCIATES	4690 Table Mountain Dr. #200 Golden, CO 80403 TEL 303.237.2072 FAX 303.237-2659	FIGURE
DRAWN BY: JWH				2
DATE: 08/27/12				

APPENDIX A

ISOTECH LABORATORIES INC.

SAMPLE RESULTS

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #:	252646	Job #:	18536
Sample Name/Number:	FURR 16-22B		
Company:	Olsson Associates		
Date Sampled:	6/19/2012	Cylinder:	56
Container:	Steel tank		
Field/Site Name:	Laramie II - Rulison Area Well Monitoring		
Location:	Furr Hagen Field		
Formation/Depth:			
Sampling Point:			
Date Received:	6/22/2012	Date Reported:	9/06/2012

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	^{14}C conc. pMC	Tritium TU
Carbon Monoxide	nd				
Hydrogen Sulfide	na				
Helium	na				
Hydrogen	nd				
Argon	na				
Oxygen + Argon	0.13				
Nitrogen	0.50				
Carbon Dioxide	2.87				
Methane	89.25	-37.41		0.7 ± 0.1	< 10.0
Ethane	4.75				
Ethylene	nd				
Propane	1.46				
Propylene	nd				
Iso-butane	0.315				
N-butane	0.313				
Iso-pentane	0.130				
N-pentane	0.0906				
Hexanes +	0.193				

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1065
Specific gravity, calculated: 0.640

Remarks:

Isotech cylinder # 56A

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #:	252647	Job #:	18536
Sample Name/Number:	FURR 16-22X		
Company:	Olsson Associates		
Date Sampled:	6/19/2012	Cylinder:	75
Container:	Steel tank		
Field/Site Name:	Laramie II - Rulison Area Well Monitoring		
Location:			
Formation/Depth:			
Sampling Point:			
Date Received:	6/22/2012	Date Reported:	9/06/2012

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	^{14}C conc. pMC	Tritium TU
Carbon Monoxide	nd				
Hydrogen Sulfide	na				
Helium	na				
Hydrogen	nd				
Argon	na				
Oxygen + Argon	0.066				
Nitrogen	0.31				
Carbon Dioxide	3.09				
Methane	89.57	-37.52		< 0.2	< 10.0
Ethane	4.69				
Ethylene	nd				
Propane	1.33				
Propylene	nd				
Iso-butane	0.286				
N-butane	0.272				
Iso-pentane	0.116				
N-pentane	0.0807				
Hexanes +	0.190				

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1061
Specific gravity, calculated: 0.638

Remarks:

Isotech cylinder # 75A

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH®
ISOTECH LABORATORIES INC
1308 Parkland Court Champaign, IL 61821 • (877) 362-4190 • www.isotechlabs.com

Send Data and Invoice to

Name: James Hix
Company: Olsson Associates
Address: 4690 Table Mtn Dr.
Ste 200, Golden, Co 80403
Phone: 303.237.2072
Fax: 303.237.2659
Email: jhix@olssonassociates.com

Project: Laramie II - Rulison Area Well Monitoring
Purchase Order #:
Location: Furr Hagen Field
Sampled By: TPD
Circle one: ~~Standard~~
Priority
Rush

Sample Description

Container Number	Sample Identification	Date Sampled	Time	Analysis Requested: Tritium	Analysis Requested: Carbon-14	Analysis Requested:	Comments
56A	Furr 16-22B	6/9/12	1400	x	x		*
75A	Furr 16-22x	6/15/12	1410	x	x		*
							NEED FULL QA/QC
							PACKAGE *

Chain-of-Custody Record

Signature	Company	Date	Time
Relinquished by	Olsson Associates	6/20/12	1700
Received by Maggie Simmons	ISOTECH	6/21/12	0900
Relinquished by			
Received by			
Relinquished by			
Received by			

Samples Submitted to

Beta Analytic

Analysis Requested by

Steve Pelphrey

Isotech Laboratories, Inc.

1308 Parkland Court

Champaign, IL 61821-1826

ISOTECH

Sample Identification

Sample Number	Type or Description of Sample	Carbon-14 Analysis	Tritium Enrichment	Tritium Analysis	Tritium Counting Only	Comments
252646	C14-C1 (1.73cc)	✓				
252647	C14-C1 (1.76cc)	✓				

Analyses & Services Requested

Chain of Custody Record

Signature	Company	Date	Time
Relinquished by Doug Riney	Shipped via UPS	7/3/12	4:00
Received by			
Relinquished by			
Received by			
Relinquished by			
Received by			

Upon receipt please sign this form and FAX a copy to (217) 398-3493.
The original should then be returned with the analytical results.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Water Analysis

Lab Number: 252333 Job Number: 18529

Submitter Sample Name: FURR 16-22B

Submitter Sample ID:

Submitter Job #:

Company: Olsson Associates

Field or Site: Laramie II - Rulison Area Well Monitoring

Location: Furr Hagen Field

Depth/Formation:

Container Type: 1 Liter Plastic Bottle

Sample Collected: 6/19/2012 Results Reported: 7/13/2012

δD of water	----------	na	
$\delta^{18}O$ of water	----------	na	
Tritium content of water	----------	< 10.0	TU
$\delta^{13}C$ of DIC	----------	na	
^{14}C content of DIC	----------	na	
$\delta^{15}N$ of nitrate	----------	na	
$\delta^{18}O$ of nitrate	----------	na	
$\delta^{34}S$ of sulfate	----------	na	
$\delta^{18}O$ of sulfate	----------	na	

Remarks:

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Send Data and Invoice to

Name: James Hix
Company: Olsson Associates
Address: 4690 Table Mtn. Drive
STE 200, Golden, CO 80403
Phone: 303.237.2072
Fax: 303.237.2659
Email: jhix@olssonassociates.com

Project: Laramie II - Bulison Area Well Monitoring
Purchase Order #:
Location: Furr Hagen Field
Sampled By: TPD
Circle one: (Standard) Priority Rush

Sample Description

Container Number	Sample Identification	Date Sampled	Time	Analysis Requested: Tritium			Comments
	FURR 16-22B	6/19/12	1330	X			*Need Full QA/QC Package Please*

Chain-of-Custody Record

Signature	Company	Date	Time
Relinquished by	Olsson Associates	6/20/12	1700
Received by Maggie Simmons	ISOTECH	6/21/12	0900
Relinquished by			
Received by			
Relinquished by			
Received by			

APPENDIX B

GEL LABORATORIES LLC

SAMPLE RESULTS

(Abridged Report – See Full Report on CD)

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Qualifier Definition Report
for

OLSS001 Olson Associates

Client SDG: 306472 GEL Work Order: 306472

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria

** Analyte is a surrogate compound

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

UI Gamma Spectroscopy--Uncertain identification

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature: Theresa L Austin **Name: Theresa Austin**

Date: 16 JUL 2012 **Title: Group Leader**

Sample Data Summary

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: July 16, 2012

Company : Olsson Associates
Address : 4690 Table Mountain Drive
Suite 200
Golden, Colorado 80403
Contact: Mr. James Hix
Project: Laramie Energy II - Rulison Furr 16-22B

Client Sample ID: FURR 16-22B
Sample ID: 306472001
Matrix: Water
Collect Date: 19-JUN-12 13:30
Receive Date: 21-JUN-12
Collector: Client

Project: OLSS00111
Client ID: OLSS001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Liquid (Standard List) "As Received"												
Actinium-228	U	13.6	+/-9.96	21.6		pCi/L		KXG3	06/30/12	1211	1224410	1
Americium-241	U	11.7	+/-13.3	21.8		pCi/L						
Antimony-124	U	-0.389	+/-4.98	10.1		pCi/L						
Antimony-125	U	-3.6	+/-6.77	11.4		pCi/L						
Barium-133	U	0.231	+/-3.32	5.28		pCi/L						
Barium-140	U	-0.235	+/-4.09	8.28		pCi/L						
Beryllium-7	U	-0.0167	+/-18.9	36.2		pCi/L						
Bismuth-212	U	18.7	+/-35.9	71.2		pCi/L						
Bismuth-214		18.6	+/-9.11	8.88		pCi/L						
Cerium-139	U	-1.84	+/-2.24	3.81		pCi/L						
Cerium-141	U	5.08	+/-4.51	8.69		pCi/L						
Cerium-144	U	0.583	+/-15.8	28.8		pCi/L						
Cesium-134	U	1.20	+/-2.47	5.02		pCi/L						
Cesium-136	U	-3.62	+/-5.46	9.09		pCi/L						
Cesium-137	U	0.947	+/-2.20	4.45	10.0	pCi/L						
Chromium-51	U	1.35	+/-24.0	43.3		pCi/L						
Cobalt-56	U	-1.61	+/-2.79	4.80		pCi/L						
Cobalt-57	U	-1.75	+/-2.17	3.74		pCi/L						
Cobalt-58	U	-1.36	+/-2.57	4.47		pCi/L						
Cobalt-60	U	0.212	+/-1.90	4.02		pCi/L						
Europium-152	U	-3.57	+/-7.98	13.6		pCi/L						
Europium-154	U	-4.19	+/-5.37	9.09		pCi/L						
Europium-155	U	6.31	+/-9.10	17.2		pCi/L						
Iridium-192	U	-1.47	+/-2.61	4.41		pCi/L						
Iron-59	U	-3.14	+/-4.92	8.74		pCi/L						
Lead-210	U	-126	+/-211	348		pCi/L						
Lead-212	UI	0.00	+/-9.15	9.13		pCi/L						
Lead-214	UI	0.00	+/-9.35	14.5		pCi/L						
Manganese-54	U	-1.94	+/-2.20	3.56		pCi/L						
Mercury-203	U	1.71	+/-2.50	4.77		pCi/L						
Neodymium-147	U	16.1	+/-28.9	58.1		pCi/L						
Neptunium-239	U	-14.5	+/-23.0	40.1		pCi/L						
Niobium-94	U	-0.0112	+/-2.22	4.18		pCi/L						
Niobium-95	U	-1.22	+/-2.86	5.03		pCi/L						
Potassium-40	U	58.4	+/-45.2	61.4		pCi/L						
Promethium-144	U	-0.523	+/-2.19	4.00		pCi/L						
Promethium-146	U	0.964	+/-2.75	5.42		pCi/L						
Radium-228	U	13.6	+/-9.96	21.6		pCi/L						

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: July 16, 2012

Company : Olsson Associates
Address : 4690 Table Mountain Drive
Suite 200
Golden, Colorado 80403
Contact: Mr. James Hix
Project: Laramie Energy II - Rulison Furr 16-22B

Client Sample ID: FURR 16-22B
Sample ID: 306472001
Project: OLSS00111
Client ID: OLSS001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Liquid (Standard List) "As Received"												
Ruthenium-106	U	0.434	+/-21.0	39.8		pCi/L						
Silver-110m	U	-0.448	+/-2.13	3.94		pCi/L						
Sodium-22	U	-1.42	+/-1.90	3.26		pCi/L						
Thallium-208	U	0.509	+/-3.02	5.38		pCi/L						
Thorium-234	UI	0.00	+/-216	180		pCi/L						
Tin-113	U	-0.0475	+/-3.09	5.55		pCi/L						
Uranium-235	U	-13.8	+/-18.2	29.9		pCi/L						
Uranium-238	UI	0.00	+/-216	180		pCi/L						
Yttrium-88	U	-0.0542	+/-2.86	5.69		pCi/L						
Zinc-65	U	-2.12	+/-4.72	8.67		pCi/L						
Zirconium-95	U	-1.03	+/-4.66	8.52		pCi/L						
Rad Gas Flow Proportional Counting												
GFPC, Gross A/B, liquid "As Received"												
Alpha	U	-13	+/-26.2	49.3	5.00	pCi/L		CYH1	07/02/12	1943	1224899	2
Beta		65.3	+/-26.2	41.7	5.00	pCi/L						
GFPC, Sr90, liquid "As Received"												
Strontium-90	U	0.0446	+/-0.908	1.65	2.00	pCi/L		VXC2	07/11/12	1912	1225010	3
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Liquid "As Received"												
Tritium	U	-244	+/-322	635	700	pCi/L		BYS1	07/06/12	0638	1226023	4
Liquid Scint Tc99, Liquid "As Received"												
Technetium-99	U	0.00	+/-17.3	30.3	50.0	pCi/L		MYM1	07/15/12	0526	1226015	5

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 901.1	
2	EPA 900.0/SW846 9310	
3	EPA 905.0 Modified	
4	EPA 906.0 Modified	
5	DOE EML HASL-300, Tc-02-RC Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Strontium Carrier	GFPC, Sr90, liquid "As Received"			111	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Liquid "As Received"			102	(15%-125%)

Quality Control Data

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis Report
for

OLSS001 Olson Associates

Client SDG: 306472 GEL Work Order: 306472

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria

** Analyte is a surrogate compound

B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.

B Metals--Either presence of analyte detected in the associated blank, or MDL/IDL < sample value < PQL

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

UI Gamma Spectroscopy--Uncertain identification

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the RL or LOQ.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed By:  07/17/12

METALS
−1−
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 306472 **METHOD TYPE:** EPA

SAMPLE ID: 306472001 **CLIENT ID:** FURR 16−22B

CONTRACT: OLSS00111

MATRIX: Water **DATE RECEIVED** 21−JUN−12 **LEVEL:** Low **%SOLIDS:**

CAS No	Analyte	Result	Units	C	Qual	M*	MDL	DF	Inst ID	Analytical Run
7440−61−1	Uranium	0.067	ug/L	U		MS	0.067	1	ICPMS4	120706−1

***Analytical Methods:**

MS EPA 200.8

GEL Laboratories LLC - Login Review Report - Chain of Custody

2040 Savage Road ~ Charleston, SC 29407
(843) 556 - 8171 (Phone) ~ (843) 766 - 1178 (Fax) ~ www.gel.com

GEL Work Order:	306472	**Work Order Due Date:**	19-JUL-12	**Collector:**	C
SDG:	306472	**Package Due Date:**	15-JUL-12	**Prelogin #:**	20120692533
Project Manager:	Edith Kent	**EDD Due Date:**	19-JUL-12	**Project ID:**	1290355
Project Name:	OLSS00111			**SDG Status:**	Closed
	Laramie Energy II - Rulison Furr 16-22B			**Logged By:**	EMK
Purchase Order:	008-2362 100 100001				
Package Level:	LEVEL5				
EDD Name:	URSC_NOBLE	**Days to Process:**	20		

Prelogin Group	QC Requirements	GEL Sample ID	Client Sample ID	Sample Description	Collect Date	Receive Date	Matrix	Chain of Custody #	Total Containers	Contingents?	Fractional Fax?	PM Comments?
1		306472001	FURR 16-22B		19-JUN-12 13:30	21-JUN-12 08:55	WATER		4			

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N=New, R=Review, P=Pending, PH=Pending Hold, H=Hold. Date is Fax Due Date, if applicable.

GEL Sample ID	Client Sample ID	200.2/200.8 Uranium Metals Path 1	GFPC, Sr90, liquid Radiochemistry Path 1	GFPC, Gross A/B, liquid Radiochemistry Path 1	Gammaspec, Gamma, Liquid (Standard List) Radiochemistry Path 1	Liquid Scint Tc99, Liquid Radiochemistry Path 1	LSC, Tritium Dist, Liquid Radiochemistry Path 1
306472001	FURR 16-22B	N	N	N	N	N	N

2040 Savage Road ~ Charleston, SC 29407
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Work Order: 306472 **Client SDG:** 306472

GEL ID:	**306472001**
Client Sample ID:	FURR 16-22B
Cooler Seal Undisturbed	Y
Temperature (C)	4

2040 Savage Road ~ Charleston, SC 29407
(843) 556 - 8171 (Phone) ~ (843) 766 - 1178 (Fax) ~ www.gel.com

Work Order: 306472 **Report Date: 25 JUN 2012**

Product: GFC90SRL **Workdef ID:** 1290356 **In Product Group?** No **Group Name:** N/A **Group Reference:** N/A
GFPC, Sr90, liquid

Method: EPA 905.0 Modified **Path:** Standard
Product Reference:
Samples: 001 **Moisture Correction:** "As Received"
Parmname Check: All parmnames scheduled properly **Status:** NEW

CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
10098-97-2	Strontium-90	2	pCi/L	REG	Y	Y	No

Product: GFCGANBL **Workdef ID:** 1290357 **In Product Group?** No **Group Name:** N/A **Group Reference:** N/A
GFPC, Gross A/B, liquid

Method: EPA 900.0/SW846 9310 **Path:** Standard
Product Reference:
Samples: 001 **Moisture Correction:** "As Received"
Parmname Check: All parmnames scheduled properly **Status:** NEW

CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
12587-46-1	ALPHA	5	pCi/L	REG	Y	Y	No
12587-47-2	BETA	5	pCi/L	REG	Y	Y	

Product: GSCGAMML **Workdef ID:** 1290358 **In Product Group?** No **Group Name:** N/A **Group Reference:** N/A
Gammaspec, Gamma, Liquid (Standard List)

Method: EPA 901.1 **Path:** Standard
Product Reference:
Samples: 001 **Moisture Correction:** "As Received"
Parmname Check: All parmnames scheduled properly **Status:** NEW

CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
14331-83-0	Actinium-228		pCi/L	REG	Y	Y	No
14596-10-2	Americium-241		pCi/L	REG	Y	Y	
14683-10-4	Antimony-124		pCi/L	REG	Y	Y	
14234-35-6	Antimony-125		pCi/L	REG	Y	Y	
13981-41-4	Barium-133		pCi/L	REG	Y	Y	
14798-08-4	Barium-140		pCi/L	REG	Y	Y	
13966-02-4	Beryllium-7		pCi/L	REG	Y	Y	
14913-49-6	Bismuth-212		pCi/L	REG	Y	Y	
14733-03-0	Bismuth-214		pCi/L	REG	Y	Y	
13982-30-4	Cerium-139		pCi/L	REG	Y	Y	
13967-74-3	Cerium-141		pCi/L	REG	Y	Y	

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CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
14762-78-8	Cerium-144		pCi/L	REG	Y	Y	
13967-70-9	Cesium-134		pCi/L	REG	Y	Y	
14234-29-8	Cesium-136		pCi/L	REG	Y	Y	
10045-97-3	Cesium-137	10	pCi/L	REG	Y	Y	
14392-02-0	Chromium-51		pCi/L	REG	Y	Y	
14093-03-9	Cobalt-56		pCi/L	REG	Y	Y	
13981-50-5	Cobalt-57		pCi/L	REG	Y	Y	
13981-38-9	Cobalt-58		pCi/L	REG	Y	Y	
10198-40-0	Cobalt-60		pCi/L	REG	Y	Y	
14683-23-9	Europium-152		pCi/L	REG	Y	Y	
15585-10-1	Europium-154		pCi/L	REG	Y	Y	
14391-16-3	Europium-155		pCi/L	REG	Y	Y	
14694-69-0	Iridium-192		pCi/L	REG	Y	Y	
14596-12-4	Iron-59		pCi/L	REG	Y	Y	
14255-04-0	Lead-210		pCi/L	REG	Y	Y	
15092-94-1	Lead-212		pCi/L	REG	Y	Y	
15067-28-4	Lead-214		pCi/L	REG	Y	Y	
13966-31-9	Manganese-54		pCi/L	REG	Y	Y	
13982-78-0	Mercury-203		pCi/L	REG	Y	Y	
14269-74-0	Neodymium-147		pCi/L	REG	Y	Y	
13968-59-7	Neptunium-239		pCi/L	REG	Y	Y	
14681-63-1	Niobium-94		pCi/L	REG	Y	Y	
13967-76-5	Niobium-95		pCi/L	REG	Y	Y	
13966-00-2	Potassium-40		pCi/L	REG	Y	Y	
14834-73-2	Promethium-144		pCi/L	REG	Y	Y	
14834-74-3	Promethium-146		pCi/L	REG	Y	Y	
15262-20-1	Radium-228		pCi/L	REG	Y	Y	
13967-48-1	Ruthenium-106		pCi/L	REG	Y	Y	
378784-24-8	Silver-110m		pCi/L	REG	Y	Y	
13966-32-0	Sodium-22		pCi/L	REG	Y	Y	
14913-50-9	Thallium-208		pCi/L	REG	Y	Y	
15065-10-8	Thorium-234		pCi/L	REG	Y	Y	
13966-06-8	Tin-113		pCi/L	REG	Y	Y	
15117-96-1	Uranium-235		pCi/L	REG	Y	Y	

2040 Savage Road ~ Charleston, SC 29407
(843) 556 - 8171 (Phone) ~ (843) 766 - 1178 (Fax) ~ www.gel.com

CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
7440-61-1	Uranium-238		pCi/L	REG	Y	Y	
13982-36-0	Yttrium-88		pCi/L	REG	Y	Y	
13982-39-3	Zinc-65		pCi/L	REG	Y	Y	
13967-71-0	Zirconium-95		pCi/L	REG	Y	Y	

Product: LSC99TCL **Workdef ID:** 1290359 **In Product Group?** No **Group Name:** N/A **Group Reference:** N/A
Liquid Scint Tc99, Liquid

Method: DOE EML HASL-300, Tc-02-RC Modified
Path: Standard
Product Reference:
Samples: 001
Moisture Correction: "As Received"
Parmname Check: All parmnames scheduled properly
Status: NEW

CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
14133-76-7	Technetium-99	50	pCi/L	REG	Y	Y	No

Product: LSCDSH3L **Workdef ID:** 1290360 **In Product Group?** No **Group Name:** N/A **Group Reference:** N/A
LSC, Tritium Dist, Liquid

Method: EPA 906.0 Modified
Path: Standard
Product Reference:
Samples: 001
Moisture Correction: "As Received"
Parmname Check: All parmnames scheduled properly
Status: NEW

CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
10028-17-8	Tritium	700	pCi/L	REG	Y	Y	No

Product: MIM2U_L **Workdef ID:** 1290361 **In Product Group?** No **Group Name:** N/A **Group Reference:** N/A
200.2/200.8 Uranium

Method: EPA 200.8
Path: Standard
Product Reference:
Samples: 001
Moisture Correction: "As Received"
Parmname Check: All parmnames scheduled properly
Status: NEW

CAS #	Parmname	Client RDL or PQL with Unit	Reporting Units	Parm Function	Included in Sample?	Included in QC?	Custom List?
7440-61-1	Uranium		ug/L	REG	Y	Y	No

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Login Requirements:

Requirement	Include?	Comments

Peer Review by:_____ Work Order (SDG#), PO# Checked?_____ C of C signed in receiver location? _____

Page: 1 of 1
Project #: 008-23602.102.100001
GEL Quote #: GELR11-1188
COC Number (1):
PO Number:

GEL Chain of Custody and Analytical Request

GEL Work Order Number: 306472

GEL Laboratories, LLC
2040 Savage Road
Charleston, SC 29407
Phone: (843) 556-8171
Fax: (843) 766-1178

Client Name: Olsson Associates James Hix Phone #: 303.237.2072
Project/Site Name: Laramie II - Rulison Area Well Monitoring Fax #: 303.237.2659
Address: 4690 Table Mtn. Dr., STE 200, Golden, CO 80403
Collected by: TPD Send Results To: jhix@olssonassociates.com

Sample Analysis Requested (5) (Fill in the number of containers for each test)

Sample ID (* For composites - indicate start and stop date/time)	*Date Collected (mm-dd-yy)	*Time Collected (Military) (hhmm)	QC Code (2)	Field Filtered (3)	Sample Matrix (4)	Should this sample be considered: Radioactive	Should this sample be considered: TSCA Regulated	Total number of containers	GAB, Gamma	Sr-90	T-99	Total U	Tritium					<-- Preservative Type (6)
FURR 16-22B	6/19/12	1330	N	N	W			4	X	X	X	X	X					

Comments
Note: extra sample is required for sample specific QC

TAT Requested: Normal: X Rush: Specify: (Subject to Surcharge)
Fax Results: Yes / No
Circle Deliverable: C of A / QC Summary / Level 1 / Level 2 / Level 3 / Level 4

Remarks: *Are there any known hazards applicable to these samples? If so, please list the hazards*

Sample Collection Time Zone
Eastern Pacific
Central Other _____
Mountain

Chain of Custody Signatures

	Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1		6/20/12	1700		6-21-12	0855
2						
3						

Sample Shipping and Delivery Details

GEL PM:
Method of Shipment: Date Shipped:
Airbill #:
Airbill #:

1.) Chain of Custody Number = Client Determined
2.) QC Codes: **N** = Normal Sample, **TB** = Trip Blank, **FD** = Field Duplicate, **EB** = Equipment Blank, **MS** = Matrix Spike Sample, **MSD** = Matrix Spike Duplicate Sample, **G** = Grab, **C** = Composite
3.) Field Filtered: For liquid matrices, indicate with a - **Y** - for yes the sample was field filtered or - **N** - for sample was not field filtered.
4.) Matrix Codes: **DW**=Drinking Water, **GW**=Groundwater, **SW**=Surface Water, **WW**=Waste Water, **W**=Water, **SO**=Soil, **SD**=Sediment, **SL**=Sludge, **SS**=Solid Waste, **O**=Oil, **F**=Filter, **P**=Wipe, **U**=Urine, **F**=Fecal, **N**=Nasal
5.) Sample Analysis Requested: Analytical method requested (i.e. **8260B**, **6010B/7470A**) and number of containers provided for each (i.e. *8260B* - **3**, *6010B/7470A* - **1**).
6.) Preservative Type: **HA** = Hydrochloric Acid, **NI** = Nitric Acid, **SH** = Sodium Hydroxide, **SA** = Sulfuric Acid, **AA** = Ascorbic Acid, **HX** = Hexane, **ST** = Sodium Thiosulfate, If no preservative is added = leave field blank

For Lab Receiving Use Only
Custody Seal Intact? YES NO
Cooler Temp: 4 C

WHITE = LABORATORY **YELLOW = FILE** **PINK = CLIENT**

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: OLSS			**SDG/AR/COC/Work Order:**
Received By: MC			**Date Received:** 6-21-12
Suspected Hazard Information	**Yes**	**No**	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
COC/Samples marked as radioactive?		✓	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): Cpm 0
Classified Radioactive II or III by RSO?		✓	If yes, Were swipes taken of sample contatiners < action levels?
COC/Samples marked containing PCBs?		✓	
Package, COC, and/or Samples marked as beryllium or asbestos containing?		✓	If yes, samples are to be segregeated as Safety Controlled Samples, and opened by the GEL Safety Group.
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		✓	

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	✓			Preservation Method: Ice bags Blue ice Dry ice None Other (describe) *all temperatures are recorded in Celsius ~~4C~~
2a	Daily check performed and passed on IR temperature gun?	✓			Temperature Device Serial #: 51049919 Secondary Temperature Device Serial # (If Applicable):
3	Chain of custody documents included with shipment?	✓			
4	Sample containers intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5	Samples requiring chemical preservation at proper pH?			✓	Sample ID's, containers affected and observed pH: If Preservation added, Lot#: Preserved Bottle Have pH = 4 * see Below
6	VOA vials free of headspace (defined as < 6mm bubble)?		✓		Sample ID's and containers affected:
7	Are Encore containers present?			✓	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	✓			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✓			Sample ID's affected:
12	Are sample containers identifiable as GEL provided?	✓			
13	COC form is properly signed in relinquished/received sections?	✓			
14	Carrier and tracking number.	✓			Circle Applicable: FedEx Air FedEx Ground UPS Field Services Courier Other 9660 0452 4634

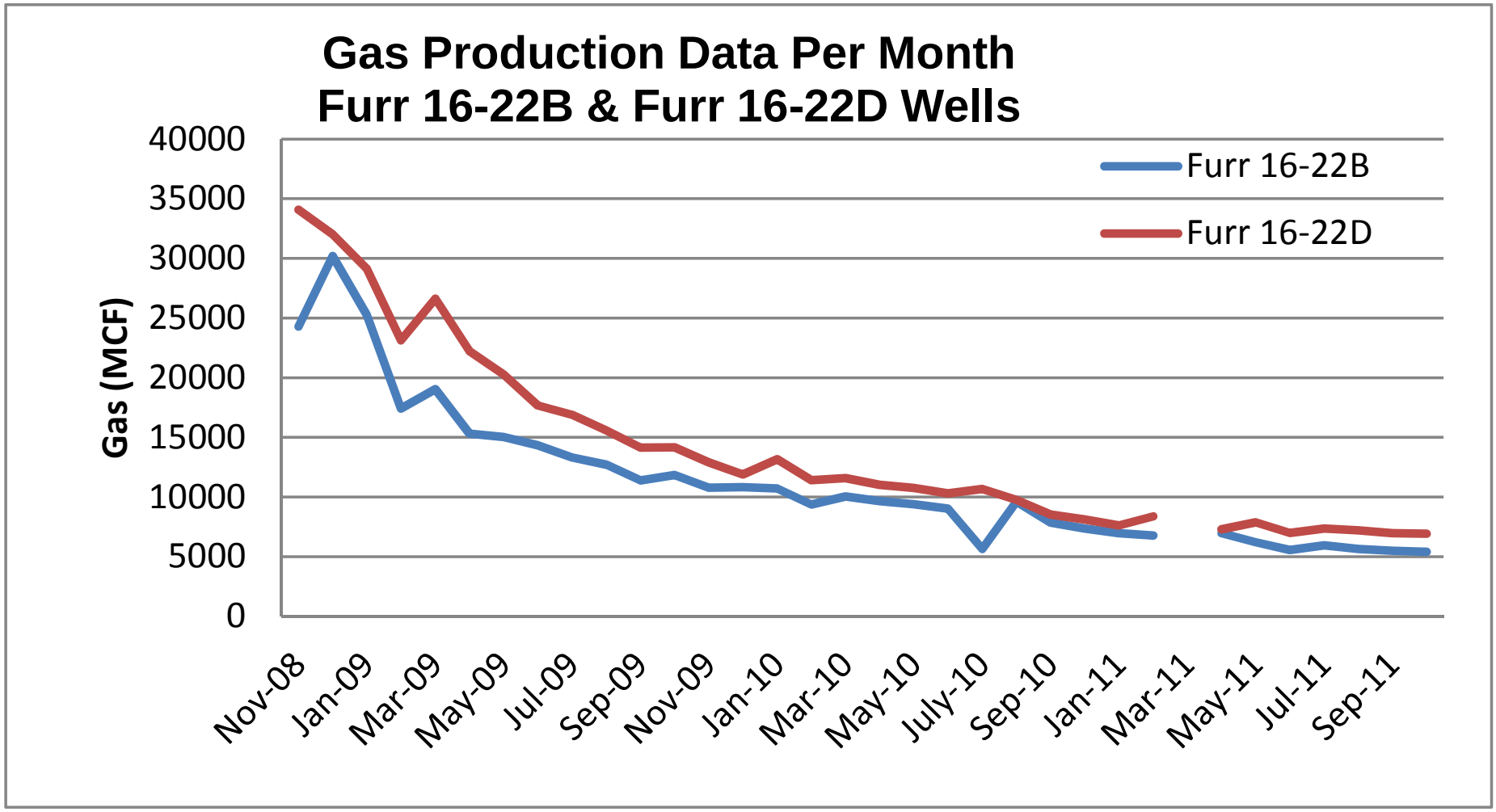
Comments (Use Continuation Form if needed):

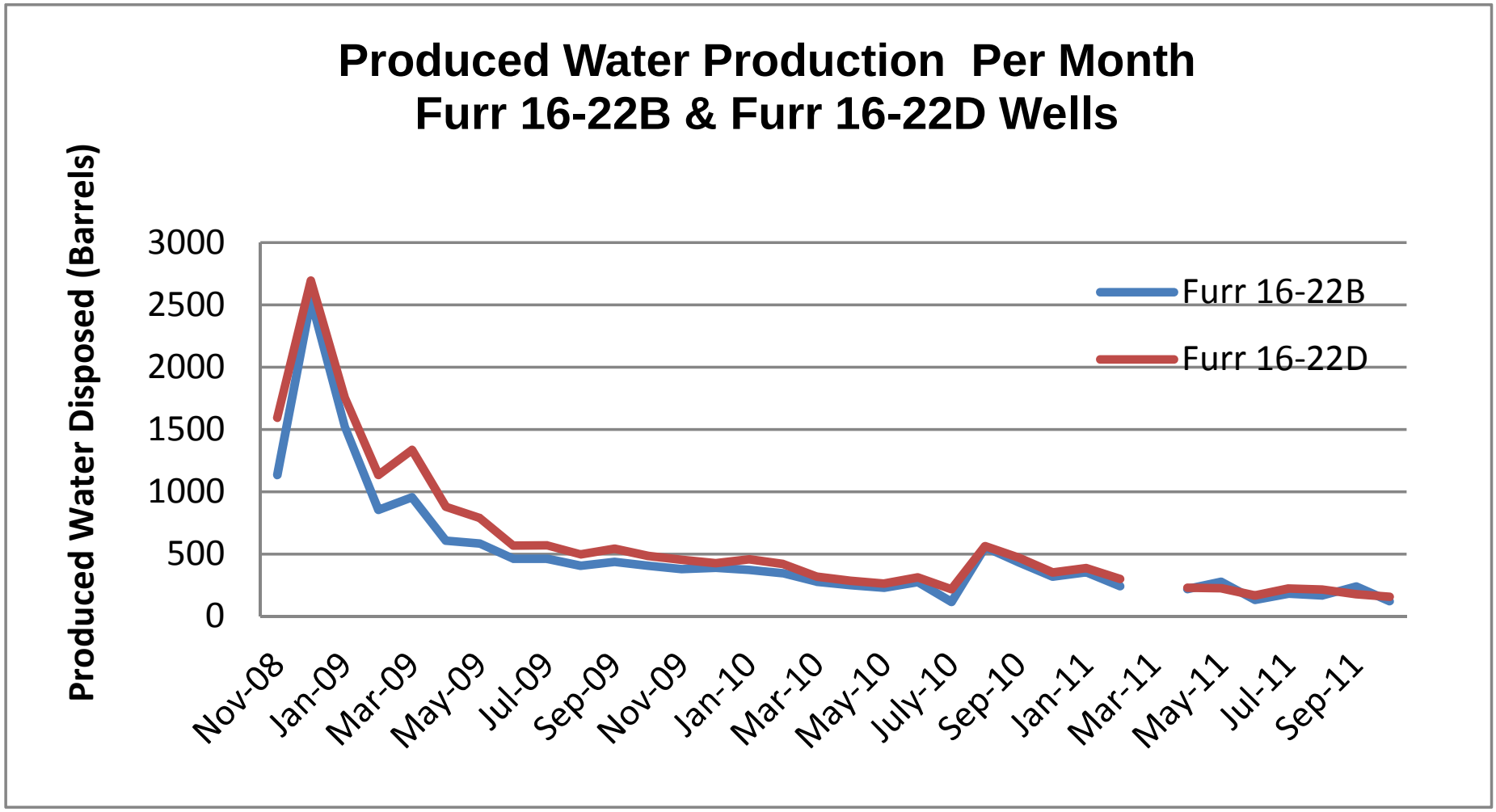
* Samples Preserved w/HNO3 per P.M. Lot # L03022

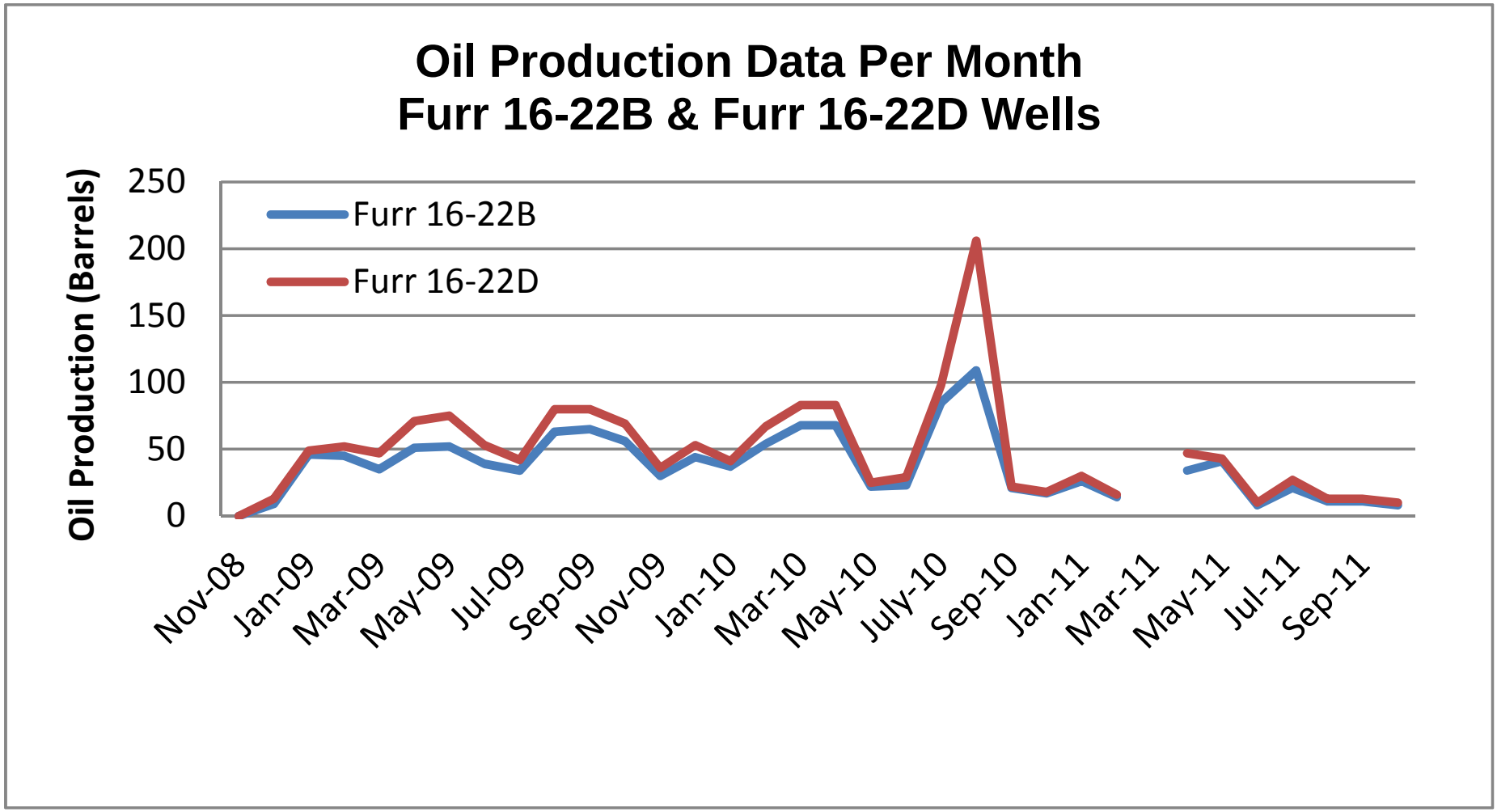
PM (or PMA) review: Initials EM Date 6/21/12 Page 1 of 1

APPENDIX C

Furr 16-22B WELL PRODUCTION DATA


Gas Production Data Per Month
Furr 16-22B & Furr 16-22D Wells
Gas (MCF)
40000
35000
30000
25000
20000
15000
10000
5000
0
Furr 16-22B
Furr 16-22D
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Jan-10
Mar-10
May-10
July-10
Sep-10
Jan-11
Mar-11
May-11
Jul-11
Sep-11


Produced Water Production Per Month
Furr 16-22B & Furr 16-22D Wells
Produced Water Disposed (Barrels)
3000
2500
2000
1500
1000
500
0
Furr 16-22B
Furr 16-22D
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Jan-10
Mar-10
May-10
July-10
Sep-10
Jan-11
Mar-11
May-11
Jul-11
Sep-11


Oil Production Data Per Month
Furr 16-22B & Furr 16-22D Wells
Oil Production (Barrels)
250
200
150
100
50
0
Furr 16-22B
Furr 16-22D
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Jan-10
Mar-10
May-10
July-10
Sep-10
Jan-11
Mar-11
May-11
Jul-11
Sep-11

APPENDIX D

DATA VERIFICATION AND VALIDATION REPORT

DIANE SHORT & ASSOCIATES, INC.
1978 S. Garrison St. # 114
Lakewood CO 80227
303:271-9642 Fax 988-4027
dsa7cbc@eazy.net

RADIOCHEMISTRY DATA QUALITY REVIEW REPORT
Gas Flow Proportional Counting (GFPC) and Liquid Scintillation (LSC)
Tritium Analysis in Gas by Combustion followed by LSC
Carbon-14 Analysis in Gas by Combustion followed by LSC

SDG: GEL: 306472
ISOTECH: 18529, 18536

PROJECT: Piceance Energy, a subsidiary of Laramie Energy II , Olsson Project #: 012-1919

LABORATORY: GEL Laboratories, LLC, Charleston, South Carolina; IsoTech Laboratories , Champaign, Illinois for Tritium in water and tritium and C-14 in gas (C-14 analysis subcontracted to Beta Analytic, Miami, Florida)

SAMPLE MATRIX: Water, Gas SAMPLING DATE (Mo/Yr): June 19, 2012

NO.SAMPLES: 1 (for tritium, 2 gas samples (sample and a duplicate) and 1 water sample)

ANALYSES REQUESTED: GEL: GFPC for Cl-36, gross alpha/beta, and Sr-90; LSC for Tc-99, LSC for tritium; IsoTech: LCS for tritium and C14 in water and gas

SAMPLE NUMBERS: Furr 16-22B

DATA REVIEWER: John Huntington

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: DLS 1/16/13

Telephone Logs included Yes____ No __X___

Contractual Violations Yes____ No __X___

The project Quality Assurance Project Plan (QAPP), the EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, 2004, the laboratory Standard Operating Procedure (SOP), and the EPA Radiochemistry Methods (current updates) have been referenced by the reviewer to perform this data validation review. The review includes evaluation of calibration, holding times and QC for all samples and a 10% review of the calculation algorithms. General comments regarding the data/ analytical quality are part of the review when raw data are submitted. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the project Manager.

I. DELIVERABLES

1. All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.
Yes ____ No__X_
The following is noted:

C-14 QC: Beta Analytic is still unable, or unwilling, to provide raw data. Tthey do provide standards on which they state that their results are based. Without the raw data, it is not possible to confirm that the QC reports are in fact directly related to the samples in question or that the results reported match the actual results obtained in the laboratory. While this does not invalidate the data, it means that the C-14 validation cannot rise to the level of review requested. All the standards provided are within acceptance limits.

GEL also performed tritium analysis on water samples. The GEL data packages include standard certifications, quench curves, spectrum plots, and all raw data.
The IsoTech packages do not contain this level of information, but do include count data, standard data, and detailed calculations. The package also contains efficiency determination data, and the package is adequate for the purposes of validation.

II. ANALYTICAL REPORT FORMS

1. The Analytical Report or Data Sheets are present and complete for all requested analyses.
Yes _X___ No____

2. Holding Times
A. The contract holding times were met for all analyses.
Yes __X__ No____

B. Samples were properly preserved, or applicable preservative was used.
Yes _X___ No____
Water samples were received at a pH > 2. The sample containers were pre-preserved but the buffering capacity of the water (these are production water from gas wells) was such that the resulting pH was above 2. The laboratory added preservative to bring the sample pH into the acceptance range. This is permissible per 40CFR and has no impact on the results. No qualifiers are added.

3. Chains of Custody (COC)
A. Chains of Custody (COC) were reviewed and all fields were complete, signatures were present and cross outs were clean and initialed.
Yes __X__ No ____
All chain of custody documentation is present and properly documented for all laboratories involved.

III. CALIBRATION AND STANDARDIZATION

1. Daily counting efficiency (Base Efficiency) for all methods was achieved.

Yes __X___ No____ NA____

2. The calibration data include a plot of the counting efficiency obtained versus the various weights of salts spiked with a known DPM of the standard; The "best fit" curve or a computer fit equation with the estimated standard deviation meet the method calibration criteria. At least one complete self-absorption curve exists for one detector per array and the efficiency for the standard curve of $\geq$ 3 standards agree within 95% confidence level.
Yes __X___ No_____ NA ____

3. Reliability of the daily QC check standards are within a 2 to 3 sigma control limit of the mean count of long term counting
Yes __X__ No_____ NA____

4. The most recent background count duration is at least as long as the sample duration and this background total is within 99% confidence level or 2 to 3 sigma of the average of the last ten background checks on that detector.
Yes __X___ No_____ NA____

5. The attenuation was with the (beta x r2) limits as appropriate to the method.
Yes __X___ No ____ NA__

6. There is documentation to verify that the standards are NIST traceable or the equivalent.
Yes _X____ No_____ NA____

7. Quench factors were reported and noted as acceptable.
Yes __X__ No____ NA__ __

IV. DETECTION AND REPORTING LIMITS

1. Minimal detection concentrations (MDC) with efficiencies were established for all analytes every six months or whenever a significant background or instrument response is expected (e.g., detector change).
Yes ___X___ No _____ NA_____

2. The laboratory reported the results with uncertainties that included all uncertainties associated with the preparation and analytical procedures.
Yes __X_ No____
Samples where uncertainties are greater than the result or the result has been reported as estimated "J" may have unrealistically low MDC values. The uncertainties are multiplied by 1.65. If the result is greater than the reported MDC, the isotope has been qualified UJQ for an unrealistically low MDC. If the value calculated is less than the reported MDA, the activity result is qualified JQ estimated below the MDC.

No such instances are observed and no qualifiers are applied.

Gross Alpha and Beta: There were detections observed for gross alpha or gross beta. The reporting limit is elevated due to matrix effects. The samples contain high TDS and the total weight must be kept to a level within the calibration range. This limits the sample size and therefore the reporting limit.

Tritium and C-14: Tritium analysis was conducted by both IsoTech and GEL laboratories on water samples. The GEL results are reported in pCi/L and the IsoTech results are reported in TU (tritium units). For water, 1 TU is 3.231 pCi/L. After conversion, the GEL results have significantly higher reporting limits, but they are consistent with the results from IsoTech.

Uncertainties are not included in the reports from IsoTech laboratories. However, the raw data provides the uncertainties and the review has been conducted using that information.

V. MATRIX SPIKE

1. Matrix spike (MS) was analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes _X__ No ____
The following MS/MSDs were conducted. For the gross alpha/beta analysis, an MS/MSD was conducted, but it was on a sample from a different SDG. For the other methods, a matrix spike was conducted plus a sample duplicate.

SDG	Method	Client Sample ID	Lab Sample ID
306472	EPA 905.0 Modified (Sr-90)	Furr 16-22B	306472001
306472	EPA 906.0 Modified (Tritium)	Furr 16-22B	306472001
306472	E EML HASL-300, Tc-02-RC Modified	Furr 16-22B	306472001

Although not all methods were spiked in this sample set, the recommended frequency of matrix spikes has been met.

IsoTech: IsoTech has not provided matrix spike results for tritium or C-14 analysis.

2. The MS percent recoveries were within the limits defined in the contract or a guidance limit of 75-125%.
Yes __X__ No ____
For those noted above.

3. The samples used for qualification are client samples.
Yes __X_ No___

VI. MATRIX DUPLICATE

1. The matrix spike duplicate relative percent difference of the percent recoveries were within the limits defined in the contract or the CLP 20% for water and 35% for soil, or $\pm$ RL for results < 5 x RL ($\pm$ 2x RL for soils).
Yes __X__ No _____ NA_____
Matrix duplicates, not matrix spike duplicates, were analyzed using the same samples as were used

for the matrix spikes. In the case of gross alpha and beta, a matrix spike duplicate was analyzed. All were in control. No qualifiers are added.

IsoTech: IsoTech has not provided duplicate results for tritium analysis.

B. Or met the Duplicate Error Ratio (DER) criteria calculations which account for the 2 sigma efficiency values. DER limit is 1.
Yes ____ No ____ NA ___X_

VII. LABORATORY CONTROL SAMPLE

1. Laboratory Control Sample (LCS) was analyzed for every analysis performed and for every 20 samples or for every matrix, whichever is more frequent
Yes __X__ No____
IsoTech data includes NIST standards run with each sample run. These are all in control.

2. The LCS %R for each analyte (background corrected) met the established control limits or the method limits of 75-125%.
Yes __X__ No ____

3. The LCSD %R for each analyte (background corrected) met the established control limits or the method limits of 75-125%.
Yes ____ No ____ NA__X__
LCSDs are not reported.

4. The duplicate relative percent difference of the percent recoveries were within the limits.
Yes ____ No _____ NA__X__

VIII. BLANKS

1. Low-level activities of isotopes were reported for laboratory preparation blanks and met the MDC or background CPM criteria
Yes _X__ No_____
For LSC methods, the MDC of the prep blank shall be less than the calibration MDC or the sample MDC whichever is reported. If all sample results in a batch are reported as detected, then the prep blank MDC must be less than the activity of the lowest MDC in the batch.

For the GFPC methods, if a sample activity is < 5 x MDC, the activity of the prep blank shall be equivalent to zero when the measurement uncertainty is considered or shall be less than the MDC. If the sample activity is > 5 x MDC, the activity of the prep blank shall be equivalent to zero when the measurement uncertainty is considered. This is determined from the Normalized Absolute Difference (NAD).

The impact of the blank contamination may be evaluated where appropriate by calculating the Normalized Absolute Difference (NAD) for the Method Blank and subsequent evaluation criteria as defined in the Army Corp. guidance section III and elsewhere. When the NAD is found to be

greater than 1.96 but less than 2.58, the sample results are qualified JMB# where # represents the isotopes blank activity. Such results are considered to be estimated and possibly undetected values due to the presence of blank contamination.

GEL, gross alpha/beta: The raw data provides all of the necessary information to evaluate the method blanks. The measurement uncertainty is less than the MDC and the sample results are all < 5x MDC. No qualifiers are required.
GEL, Sr-90: Sample results are all non-detects and the method blank raw results are less than MDC. No qualifications are required.
GEL, Tc-99: Sample results are all non-detects and the method blank raw results are less than MDC. No qualifications are required.
IsoTech: Blanks are present in each run of samples and are within acceptance windows.
Beta Analytic (C-14 analysis): Background levels reported are within acceptance limits.

2. The cross talk summary was acceptable and indicated no interferences
Yes _X__ No_____ NA____
These are provided only for samples submitted to Gel Laboratories.
This is not applicable to the tritium analysis.

IX. CHEMICAL YIELD SUMMARY
Chemical Yield (Tracer) Summary was analyzed to monitor the accuracy of percent samples recoveries and the percent recoveries were within the control limits.
Yes __X__ No ____ NA ____
GEL: Chemical yield recoveries are reported Sr-90 and Tc-99. The recoveries reported are within limits.

Beta Analytic: The C-14 analysis proceeds by first converting all carbon to carbon dioxide, reducing the carbon dioxide to benzene, and determining the C-14 content by LSC. In this process the purity of the benzene is determined (the method for this is not specified). This information has not been provided in this data set.

X. FIELD QC
A. If Field duplicates or Performance Check Compounds were identified, they met the RPD or % recovery criteria for the project. Guidelines of 35% RPD for water were used unless the reported results are < 5 x Reporting Limit (RL) in which case 2 x RL difference is acceptable.
Yes __X_ No____ NA ____
The gas sample submitted for tritium and C-14 analysis had a field duplicate associated with it. The results for tritium were in control, both sample and field duplicates < 10 TPU.

The result for C-14 was 0.7 +/- 0.1 pmc (percent modern carbon) and the duplicate result was < 0.2 pmc. The difference is outside the 2xRL limit and so there is some indication of non-homogeneity. However, it is our understanding that both levels are within normally-expected background for C-14.

B. For low level data, the following DER calculations can be applied.
The Normalized Absolute Difference for isotopes with activities $\leq$ 5X the MDC is considered for data validation rather than the Relative Percent Difference (RPD). If the NAD calculated is 1.96 < x > 3.29 the results for all samples have been qualified JD# where # represents the NAD calculated. If the NAD calculated were greater than 3.29 the results would be rejected. If the results are less than 1.96 no qualification has been made. Where results are greater than 5X the MDC the RPD is considered for data validation.
Yes___ No___ NA__X_

XI. CALCULATIONS
The calculation algorithm has been checked for 10% of the submitted data packages and accuracy of the reported results is verified.
Yes __X___ No _____ NA____
The calculations for the samples are provided in detail as printouts of the spreadsheets used. The calculations can be followed step-by step to reach the final result, both for counts and counting error calculations.

XII. OVERALL ASSESSMENT OF THE CASE
The data are considered fully useable for project purposes with consideration of the qualifications or comments.

Deliverables
The following is noted:

C-14 QC: Beta Analytic is still unable or unwilling to provide raw data, but they do provide standards on which they state that their results are based. Without the raw data, it is not possible to confirm that the QC reports are in fact directly related to the samples in question or that the results reported match the actual results obtained in the laboratory. While this does not invalidate the data, it means that the C-14 validation cannot rise to the level desired. All the standards provided are within acceptance limits.

GEL also performed tritium analysis on water samples. The GEL data packages include standard certifications, quench curves, spectrum plots, and all raw data. The IsoTech packages do not contain this level of information, but do include count data, standard data, and detailed calculations. The package also contains efficiency determination data, and the package is adequate for the purposes of validation.

Chain of Custody and Sample Condition
Chain of custody documentation is complete for all samples and laboratories.

Water samples were received at a pH > 2. The sample containers were pre-preserved but the buffering capacity of the water (these are production water from gas wells) was such that the resulting pH was above 2. The laboratory added preservative to bring the sample pH into the acceptance range. This is permissible per 40CFR and has no impact on the results. No qualifiers

are added.

Field Duplicates

The gas sample submitted for tritium and C-14 analysis had a field duplicate associated with it. The results for tritium were in control, both sample and field duplicates < 10 TPU.

The result for C-14 was 0.7 +/- 0.1 pmc (percent modern carbon) and the duplicate result was < 0.2 pmc. The difference is outside the 2xRL limit and so there is some indication of non-homogeneity. However, it is our understanding that both levels are within normally-expected background for C-14.

DIANE SHORT & ASSOCIATES, INC.
1978 S. Garrison St. # 114
Lakewood CO 80227
303:271-9642 Fax 988-4027
dsa7cbc@eazy.net

RADIOCHEMISTRY QUALITY REVIEW REPORT
GAMMA SPECTROMETRY

SDG: 306472

PROJECT: Piceance Energy, a subsidiary of Laramie Energy II , Olsson Project #: 012-1919

LABORATORY: GEL Laboratories, LLC, Charleston, South Carolina

SAMPLE MATRIX: Water

SAMPLING DATE (Mo/Yr): June 19, 2012

NO.SAMPLES: 1

ANALYSES REQUESTED**:** Ac-228, Ag-110m, Am-241, Ba-133, Ba-140, Be-7, Bi-212, Bi-214, Ce-139, Ce-141, Ce-144, Co-56, Co-57, Co-58, Co-60, Cr-51, Cs-134, Cs-136, Cs-137, Eu-152, Eu-154, Eu-155, Fe-59, Fe-59, Hg-203, K-40, Kr-85 (dropped from list in November sampling), Mn-54, Na-22, Nb-94, Nb-95, Nd-117, Np-239, Pb-210, Pb-212, Pb-214, Pm-144, Pm-146, Ra-228, Ru-106, Sb-124, Sb-125, Sn-113, Th-230, Th-234, Tl-208, U-235, U-238, Y-88, Zn-65, Zr-95

SAMPLE NUMBERS: Furr 16-22B

DATA REVIEWER: John Huntington

QA REVIEWER Diane Short & Associates, Inc. Initials/ Date DLS 1/16/13

Telephone Logs included Yes____ No _X___

Contractual Violations Yes____ No __X__

The project Quality Assurance Project Plan (QAPP), the EPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, (SOP), the EPA method 901.1 and the Paragon Standard Operating Procedure SOPS noted in the report have been used by the reviewer to perform this data validation review. Only a limited number of the Data Validation QC items apply to radiochemical analyses. The remaining QC items have been taken from the Paragon Method QC. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of EPA. All chains of custody, calibrations, QC Forms have been validated and qualifiers added from the QC data on the Forms and an overview of the raw data.

I. DELIVERABLES

A. All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.

Yes ___X_ No___

The following is noted:

The GEL Laboratories data package included raw data, and at client request a level IV review was conducted. The method used is EPA 901.1.

B. The Analytical Report or Data Sheets are present and complete for all requested analyses.

Yes _X___ No____

II. INSTRUMENTATION

A. The detector range is appropriate for the samples being analyzed.

Yes _X__ No___ NA __

B. The system resolution peak is within the 1332 KeV range for Co-60.

Yes _X__ No___ NA __

C. The resolution is within the 3 KeV range for Co-60.

Yes _X__ No___ NA _X_

III. STANDARDS

A. Standards were NIST traceable or equivalent.

Yes _X__ No___ NA __

Certificates were provided for all standards used, as well as calibration logs and raw data.

B. Standards for efficiency checks are counted at least once a month for each detector.

Yes _X__ No___ NA __

C. The check source standard has not shifted more than 2 channels from the centroid position.

Yes _X__ No___ NA __

This is documented in the calibration portion of the data package.

D. Samples are counted for a duration long enough to achieve the RDL.

Yes _X__ No___ NA __

E. Background counts for the same duration as the sample runs are submitted and acceptable.

Yes __X_ No___ NA __

This is provided for each sample in the raw data section.

F. Each standard is measured for peak resolution as full-width at half-maximum height (FWHM) and absolute counting efficiency and all center column readings (bounds test) "Pass".

Yes _X__ No___ NA __

G. The MDA was checked for 10% of the samples and is $\leq$ RDL.

Yes _X__ No____

IV. BLANKS

A. The method blank was analyzed at the required frequency.

Yes _X___ No____

B. And the results were within the required control limits. When average blanks or instrument background is subtracted to determine net counts, the net blank must be < 2 sigma uncertainty.
Yes __X__ No ____NA___
GEL: All results are reported as ND. No blank corrections are required.

B. Field Blanks are identified and results are below the detection limit or < 2 x IDL.
Yes ____ No ____ NA __X__
No field blank is identified.

V. SPIKE SAMPLE RECOVERY

A. A matrix (pre-digestion) spike sample was analyzed for each digestion group and/ or matrix or as required in the SOW.
Yes ____No _X___
No MS was prepared. The laboratory has not commented about the reason.
The spiking of the large sample size (~500g) required for these analyses usually prohibits the spiking of radioactive compounds. The acceptable QC sample for accuracy for this analysis is the Laboratory Control Sample (LCS).

And the Matrix spike percent recoveries were within the required control limits of 75 – 125%
Yes ____No____ NA__X___

VI. DUPLICATES

A. Matrix (pre-digestion) duplicate samples were analyzed at the required frequency.
Yes __X__ No ____

B. And met the Duplicate Error Ratio (DER) criteria calculations which account for the 2 sigma efficiency values. DER limit is 1.0 (the DOE limit is 1.42)
Yes ____ No __X__
Some analytes did not meet the DER limit, as shown below. The non-detected results are acceptable since they are non-detects in both duplicate and parent. All are non-detects and no qualifiers are applied.

Samp_ID	Lab_ID	Parameter	Conc	QAQC_Flag	RL	MDC	Count_error	Units	DER
FURR 16-22B	1202685934	Am-241	-8.45	U	34.2	34.2	22.1	pCi/L	1.53206
FURR 16-22B	1202685934	Be-7	-19.1	U	49.7	49.7	29.8	pCi/L	1.06184
FURR 16-22B	1202685934	Ce-141	-8.42	U	9.34	9.34	6.13	pCi/L	3.47525
FURR 16-22B	1202685934	Co-56	0.819	U	6.29	6.29	3.16	pCi/L	1.12886
FURR 16-22B	1202685934	Co-57	0.513	U	4.73	4.73	2.67	pCi/L	1.28609
FURR 16-22B	1202685934	Co-58	1.09	U	5.98	5.98	2.93	pCi/L	1.23242
FURR 16-22B	1202685934	Cs-136	2.76	U	12.1	12.1	5.56	pCi/L	1.60366
FURR 16-22B	1202685934	Fe-59	5.53	U	16.0	16.0	7.76	pCi/L	1.84897
FURR 16-22B	1202685934	Ir-192	0.845	U	5.77	5.77	3.06	pCi/L	1.12602
FURR 16-22B	1202685934	Mn-54	2.24	U	6.13	6.13	2.89	pCi/L	2.26012
FURR 16-22B	1202685934	Nb-94	-1.81	U	4.62	4.62	2.67	pCi/L	1.01753
FURR 16-22B	1202685934	Nb-95	2.94	U	6.71	6.71	3.13	pCi/L	1.92603
FURR 16-22B	1202685934	Pb-210	610	U	1300	1300	679	pCi/L	2.02866
FURR 16-22B	1202685934	Pb-212	3.61	U	12.2	12.2	7.06	pCi/L	1.02542
FURR 16-22B	1202685934	Pm-144	2.33	U	6.23	6.23	3.02	pCi/L	1.49697

C. If suspected "hot particles" were found, were samples re-analyzed.
Yes____ No ___ NA_X__
No hot particles found, sample results low or BDL.

VII. LABORATORY CONTROL SAMPLE
A. An LCS was analyzed at the required frequency.
Yes __X__ No____
The laboratory used a subset of the nuclide target list in the LCS. Am-241, Co-60, and Cs-137 were spiked.

B. The LCS was within a control limit of 80-120% for water and 70 – 130% for soil.
Yes _X___ No____

C. The LCS uncertainty calculation verifies that the observed value of the LCS is within 3 sigma control limits of the expected LCS value and the relative percent error does not exceed 5 %.
Yes _X___ No____

VIII. DETECTION LIMITS
A. Detection limits met the method limits.
Yes __X__ No____
The instrument detection limit was within an isotope-specific limit for the calibration standards and QC samples.

The laboratory has flagged a number of results with "UI" to indicate that they suffer from some type of detection issue. These results are qualified as JQ to indicate that they could be biased.

Samp_ID	Lab_ID	Parameter	Conc	QAQC_Flag	RL	MDC	Count_error	Units	DVAL
FURR 16-22B	306472001	Pb-212	0.00	UI	9.13	9.13	9.15	pCi/L	JQ
FURR 16-22B	306472001	Pb-214	0.00	UI	14.5	14.5	9.35	pCi/L	JQ
FURR 16-22B	306472001	Th-234	0.00	UI	180	180	216	pCi/L	JQ
FURR 16-22B	306472001	U-238	0.00	UI	180	180	216	pCi/L	JQ
FURR 16-22B	1202685934	Bi-214	0.00	UI	18.0	18.0	10.4	pCi/L	JQ
FURR 16-22B	1202685934	K-40	0.00	UI	32.5	32.5	40.5	pCi/L	JQ
FURR 16-22B	1202685934	Pb-214	0.00	UI	17.7	17.7	11.4	pCi/L	JQ

Negative results that have absolute values above the counting error or MDC could potentially indicate a low bias. There are no such cases in this data set.

B. The energy of the identified peaks are within 2 KeV of the library energy of the radionuclide.
Yes__X__ No____ NA____

C. Decay-corrected results have been reported appropriately for the short half-life results
Yes__X__ No____ NA___

D. Tentatively Identified Radionuclides (TIR)
TIRs were reported and correctly identified from the library search.
Yes____ No_____ NA__X_
No TIRs are reported.

IX. PREPARATION AND ANALYSIS LOGS

A. All samples were prepared or analyzed within the required holding times referencing the SOW (time of sample receipt to preparation/distillation).
Yes _X___ No____

B. All samples were analyzed within the EPA Method recommended holding times (time of sample collection to date of analysis).
Yes __X__ No____
No 40 CFR limits exist for radchem, so method limits were referenced. All samples were analyzed within 90 days of collection.

X. CHAINS OF CUSTODY

A. All chains of custody were complete with initials, dates, times and any changes are crossed out with one line and initialed.
Yes __X_ No ___

B. Samples arrived intact, at the proper pH (< 2) and temperature.
Yes _X__ No____
Samples were received at a pH > 2. The sample containers were pre-preserved but the buffering capacity of the water (these are production water from gas wells) was such that the resulting pH was above 2. The laboratory added preservative to bring the sample pH into the acceptance range. This is permissible per 40CFR and has no impact on the results. No qualifiers are added.

XI. FIELD QC

Field QC samples were identified and have met a guidance limit of CLP 30% for water and 50% for soil, or $\pm$ 2 x RL (water) or 3.5 x RL (soil) for results < 5 x RL. Or for radiochemistry, the results relative to the 2 sigma counting error (uncertainty) may be used. The difference between the 2 results is compared against the uncertainty for each sample result. DER of > 1 is to be discussed. No qualifiers are applied.
Yes ____ No____ NA __X__
No field duplicates are identified.

XII. OVERALL ASSESSMENT OF THE CASE

The data are considered fully useable for project purposes with consideration of the qualifications or comments.

Deliverables:
The following is noted:
The GEL Laboratories data package included raw data, and at client request a level IV review was conducted. The method used is EPA 901.1.

Sample Preservation and Chain of Custody:
Samples were received at a pH > 2. The sample containers were pre-preserved but the buffering capacity of the water (these are production water from gas wells) was such that the resulting pH was above 2. The laboratory added preservative to bring the sample pH into the acceptance range. This is permissible per 40CFR and has no impact on the results. No qualifiers are added.

Duplicates

Some analytes did not meet the DER limit, as shown below. The non-detected results are acceptable since they are non-detects in both duplicate and parent. All are non-detects and no qualifiers are applied.

Detection Limits

The instrument detection limit was within an isotope-specific limit for the calibration standards and QC samples.

The laboratory has flagged a number of results with "UI" to indicate that they suffer from some type of detection issue. These results are qualified as JQ to indicate that they could be biased.

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INORGANIC DATA QUALITY REVIEW REPORT
ICPMS-Uranium

SDGs: 306472

PROJECT: Piceance Energy, a subsidiary of Laramie Energy II , Olsson Project #: 012-1919

LABORATORY: GEL Laboratories, LLC, Charleston, South Carolina

SAMPLE MATRIX: Water

SAMPLING DATE (Mo/Yr): June 19, 2012

NO.SAMPLES: 1

ANALYSES REQUESTED: Method 200.8 (ICPMS) for uranium

SAMPLE NUMBERS: Furr 16-22B

DATA REVIEWER: John Huntington

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: DLS 1/16/13

Telephone Logs included Yes _____ No X

Contractual Violations Yes _____ No X

The project Sampling and Analysis Plan (SAP, 2010); the EPA Contract Laboratory Program National Functional Guidelines for Organic Review, 2007, as noted in the QAPP; and the cited SW-846 Methods have been referenced by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to project-specific qualifiers that include a descriptor code and value to define QC violations. Per the Scope of Work, the review includes validation of all chains of custody, calibrations, holding times, and QC forms and, where applicable, of interferences for 10% of the samples. Determining the exact analytical sequence (sequencing) was done, where applicable, on 10% of the data. General comments regarding the data/analytical quality are part of the review when raw data are submitted. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the project Manager and EPA.
NOTE: Those items in this report which have an asterisk (*) are specific to ICPMS.

I. DELIVERABLES

A. All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.
Yes __X__ No____

II. ANALYTICAL REPORT FORMS

A. The Analytical Report or Data Sheets are present and complete for all requested analyses.
Yes __X__ No _____

B. Holding Times
1. The contract holding times were met for all analyses (time of sample receipt to time of analysis).
Yes __X__ No _____

2. The applicable method holding times were met for all analyses (time of sample collection to time of analysis).
Yes __X__ No _____

3. Samples were properly preserved to pH < 2, or applicable preservative was used.
Yes _____ No __X__
The sample arrived at the laboratory with a pH of 4 and the laboratory preserved it to a pH of < 2 per 40 CFR. This is due to the buffering capacity of the water which can elevate the pH. As this is not an unusual occurrence for these matrices and acid was added as soon as samples reached the laboratory, no qualifier is required.

C. Chains of Custody (COC)
1. Chains of Custody (COC) were reviewed and all fields were complete, signatures were present and cross outs were clean and initialed.
Yes __X__ No _____

III. CALIBRATION AND STANDARDIZATION – ICP/MS

A. Initial Calibration – ICPMS
*1. Mass calibration and resolution checks for both low and high mass isotopes and are within 0.1 amu of the true value.
Yes X___ No _____ NA _____

*And produced a peak width of approximately 0.90 amu at 10% peak height.
Yes ___X_ No _____ NA _____
The specification for Method 200.8 is a peak width of 0.75 or smaller at 5% peak height. The tuning report shows that this was met.

*2. Instrument stability: Tuning solution was run a minimum of four times and RSD of absolute signals for all analytes was less than 5%.
Yes __X__ No _____ NA ____

B. Internal Standardization
*A minimum of three internal standards were present in all standards and blanks at identical levels.

Yes __X__ No _____ NA ____
Because this analysis is for one analyte only, only one internal standard is required. However, data is present for all analytes and 5 internal standards are present.

C. Instrument tune.
*The tune check was run.
Yes __X__ No _____ NA ____

D. Initial Calibration – ICP and ICPMS
1. All initial instrument calibrations were performed as defined in the contract or Statement of Work (SOW). All re-analyses were performed if required.
Yes __X__ No _____ NA_____

2. Initial Calibration checks (ICV) were within the 90 – 110% limits (80 – 120% for Hg) and the CVAA and wet chemistry, 3 to 5 point curves, the correlation coefficient must be > 0.995 for the analysis to proceed.
Yes __X__ No _____

3. Continuing calibrations (CCV) were within 90 – 110% (80 – 120% for Hg).
Yes __X__ No _____

4. The low level Contract Required Detection Limit (CRDL) standard was analyzed and the 70 - 130% limits were met (50 – 150% for ICP: Sb, Pb, Tl; ICPMS: Co, Mn, Zn).
Yes __X__ No _____

IV. INTERFERENCES
A. Isobaric elemental and molecular interferences.
1. The data were free of isobaric elemental and elemental interferences as measured by the Interference Check Sample (ICS) for both ICP and ICPMS.
Yes __X__ No _____

And the ICS percent recoveries were within the required control limits of 80 – 120%.
Yes __X__ No _____
Note that the ICS is not applicable to limited list of metals analyses as potentially interfering analytes are not reported. It is, however, checked as part of the review.

2. Oxide check
*The concentration of Cerium Oxide is less than 10% of the Cerium concentration and the concentration of Ba^{+2} is less than 3% of Ba.
Yes __X__ No _____ NA ____

B. Memory interferences
*1. Suitable rinse times were determined prior to sample analysis.
Yes __X__ No _____ NA ____
Data are not available. However, since CCBs are in control it is clear that rinse times are adequate.

*2. Memory interferences and Chloride molecular interferences (ArCl and MoO) were assessed within the standard report.
Yes __X__ No _____
All calibrations, LCS, and Interference Check Samples were within limits verifying that the computerized correction for chloride has been performed. Furthermore, these are not interferences for uranium.

V. BLANKS
Note: The highest blank associated with any particular analyte is used for the qualification process and is the value entered after the "B" blank descriptor.

A. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the required frequency.
Yes __X__ No _____ NA _____

And the ICB and CCB results were within the required control limits (non-detect to the MDL).
Yes __X__ No _____ NA _____

B. Method Blanks were analyzed at the required frequency and for each matrix and analysis.
Yes __X__ No _____

And no Blank contamination was found in the Method Blank.
Yes __X__ No _____

C. If Field Blanks were identified, no blank contamination was found.
Yes _____ No ____ NA ___X__
None of the samples were identified as field blanks.

VI. INTERNAL STANDARD RESPONSES
*1. The absolute response of the internal standard in the sample did not deviate more than 60 - 125% from the original response in the calibration blank or standard.
Yes __X__ No _____ NA ____
Internal standard areas were very stable per the raw data check.

*Or dilutions were performed as required by the method to minimize errors if the internal standard is naturally present in samples.
Yes _____ No _____ NA __X___

VII. MATRIX SPIKE
A. Matrix Spike (MS) was analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes __X__ No _____

B. The MS percent recoveries were within the limits defined in the contract or the CLP 75 - 125%.
Yes __X__ No _____
The sample was analyzed as an MS. An MSD is not analyzed but a sample duplicate is.

C. The MS/MSD samples were client samples
Yes __X__ No _____

VIII. MATRIX DUPLICATE
A. Matrix duplicate was analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes __X__ No _____

B. The matrix duplicate relative percent difference (RPD) were within the limits defined in the contract or the CLP limits of 20% for water and 35% for soil, or ± RL for water results < 5 × RL (± 2 × RL for soils).
Yes __X__ No _____

IX. LABORATORY CONTROL SAMPLE
A. A Laboratory Control Sample (LCS) was analyzed for every analysis performed and for every 20 samples or for every matrix, whichever is more frequent.
Yes __X__ No _____

B. The LCS percent recoveries were within the limits defined in the contract or the EPA limits of 80 – 120%.
Yes __X___ No

X. SERIAL DILUTION.
A serial dilution of 1:4 was performed for 1/20 samples when an analyte is greater than 50 × IDL (> 100 × IDL for ICPMS).
Yes __X__ No ___NA___
Uranium was not detected in the sample so no serial dilution is appropriate. However, the laboratory performed the serial dilution anyway.

B. And the % Difference between the diluted sample results is ≤ 10% for the client sample or sample with a matrix known to match the client matrix.
Yes _____ No _____ NA __X__
Samples had no detectable uranium so the serial difference criterion does not apply. Both the sample and its dilution are non-detect.

XI. INSTRUMENT DETECTION LIMITS
A. The Instrument Detection Limits have met the Quarterly criteria.
Yes____ No___ NA__X__
Quarterly IDL reports are not required of Method 200.8.

And all sample results have met the required detection limits (CRDL).
Yes __X__ No _____

XII. FIELD QC
If Field duplicates or Performance Check Compounds were identified, they met the RPD guidance of 35% RPD for water or 50% RPD for soils. For values < 5 × RL, a difference of

± 2 × RL is used for water and ± 4 × RL is used for soils. Data are not qualified for field duplicates as the final decision on field precision is made by the project manager.
Yes _____ No _____ NA __X__
No field duplicates were identified to the validator.

XIII. OVERALL ASSESSMENT OF THE CASE
The data are considered fully useable for project purposes. No qualifiers have been added.