Laramie Energy II, LLC
2011 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

Laramie Energy II, LLC (Laramie Energy II) has developed natural gas resources in the vicinity of Jack's Pocket on the north flank of Battlement Mesa in Garfield County, Colorado. The first Furr Lease gas wells were originally drilled by Petrohunter Operating Co. and GSL Energy Corp. and were purchased and completed by Laramie Energy II in 2008. Since then Laramie Energy II has drilled and completed additional gas wells in the area.

Laramie Energy II 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), revision 3, July 2010, requirement developed by URS Corporation (URS) for all natural gas wells within a three-mile radius of the former Project Rulison site.

The Laramie II natural gas wells discussed in this report are all located within a 3-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. This report presents the 2011monitoring data for the Furr 16-22B Sentinel gas well.

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

In general, the RSAP requires all companies drilling or producing natural gas wells within specified zones and sectors surrounding the former Rulison test 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 current RSAP states:

"If a Tier II well is the closest designated well in a monitoring sector (i.e. no Tier I well), produced water and natural gas shall be sampled and analyzed for the radiological analytes listed in Table 3 and produced water for the non-radionuclides listed in Table 4 quarterly during year 1, semi-annually during years 2 and 3, and annually thereafter."

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. Laramie Energy II's Furr Gas wells are shown more specifically on Figure 2.

The Furr 16-22 B is the closest Laramie Energy II Tier II gas well in monitoring sector 11. There are no Tier I wells located within monitoring sector 11, so the Furr 16-22B is a sentinel Tier II well. Therefore, natural gas and produced water samples were collected from the separator for the Laramie Energy II Furr 16-22B Tier II sentinel well on May 23, 2011 and again on November 29, 2011.

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, and November 2011 do not indicate the presence of any Project Rulison related radioactivity. A summary table of Laramie Energy II well locations and sampling activities is presents as Table 1. Laboratory analytical results for gas and produced water samples collected from the Furr 16-22B Tier II 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 RSAP, Revision 3, issued in July 2010.

The URS RSAP defines Tier II wells as those gas wells located outside the 1-mile radius, but within the 3-mile radius of Project Rulison; whereas Tier I wells are defined as those gas wells located within the 1-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 or 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 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 frac-ing 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.

1.2 Laramie Energy II Furr 16-22B Tier II Sentinel Gas Well

The Furr 16-22B is a directionally drilled gas well which means that the bottom of the well is located 653 feet north and approximately 48 feet east of the surface location. The Furr 16-22B bottom hole location (990 from south line (FSL) of the section and 330 from east line (FEL) of the section) is further away from Project Rulison than the Furr 16-22B surface location (337 FSL and 282 FEL), but the Furr 16-22B well is the closest Tier II well in monitoring sector 11, to the Project Rulison test site.

The Furr 16-22B was sampled for the first time on December 17, 2008 as part of the baseline sampling, and was sampled again on June 24, 2009, on October 1, 2009, December 16, 2009, in October 2010, May 23, 2011, and November 29, 2011. The Furr 16-22 B was shut-in on April 14, 2009, and could not be sampled at that time.

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

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

The data verification and validation reports prepared by Diane Short and Associates are included as Appendix D. The data validation reports initially prepared in February 2012, noted that the chain-of-custody documents from

Isotech to Beta Analytics were not signed and that the raw data for the ^{14}C analysis was not provided. The original data verification and validation report also noted that GEL Laboratories had not provided the raw data for the total uranium analysis and that the RSAP required an evaluation of ten percent of the data. Therefore, this additional information was requested of BETA, Isotech, and GEL Laboratories.

1.3 Tier II Zone Drilling Monitoring Requirements

The drilling monitoring requirements in the RSAP consist of a review of the open- or cased-hole gamma-ray logs through the Williams Fork Formation interval for evidence of elevated gamma radiation. This review is conducted to determine whether there is potential evidence of Project Rulison-related gamma radiation observed in the formation during gas well drilling. The gamma-ray logs also detect naturally occurring radionuclides such as potassium-40, uranium, and thorium isotopes. According to the URS RSAP, the logs will be reviewed for evidence of above normal gamma-ray signatures. A gamma radiation measurement greater than 500 API gamma units or any other gamma readings that appear to be anomalous are to be noted by the drilling supervisor or his designated representative and immediately reported to the Company management and the [radiation safety officer] RSO for review and guidance. Mr. Richard Henry with URS has agreed to act as RSO for Laramie Energy II.

A review of the well logs for the Furr 16-22B and Furr 16-22D wells on the COGCC website database shows that gamma-ray signatures were typically less than 200 API gamma units. Special attention was paid to the well log intervals from below 6,000 feet to the bottom of each the wells. Copies of these logs were presented and discussed in the first quarter 2009 report.

1.4 Data Verification and Validation Requirements

Section 9 of the RSAP outlines the data verification and validation requirements. Olsson previously retained Diane Short & Associates of Lakewood, Colorado to perform the independent data validation on the November and December 2008 radiochemistry and non-radiochemistry baseline and production data.

Olsson again retained Diane Short & Associates to perform data verification and validation on the radiochemistry parameters for the 2011 production data for the Furr 16-22B. Their review identified missing information from the laboratories that Olsson requested from Isotech and Beta Analytic laboratories, and GEL. The data verification and validation report is included as Appendix E.

1.5 Background Radiation Studies

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.

One tritium unit (TU) is equivalent to 3.2 picocuries per liter (pCi/L). 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).

Today natural background tritium levels in precipitation 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.

According to the USGS Open File Report 474-68, Geohydrology - Project Rulison (Voegeli, West, and Cordes, 1970), intervals below 6,000 feet below ground surface (bgs) in the R-EX hole were analyzed in 1968 for the presence of gross alpha as Uranium equivalent and gross beta as ^{90}Sr-^{90}Y. The gross alpha activities ranged from < 0.4 µg/L to 9.8 µg/L, and gross beta activities ranged from 29 pCi/L to 70 pCi/L (Voegeli, 1969).

Olsson obtained a copy of the Basic Data Report No. 7 - Radiochemical Analyses of Ground and Surface Water in Colorado, 1954-1961 (Scott and Voegeli, 1961), a study conducted by the USGS in cooperation with the Colorado Water Conservation Board. Tritium activities were not analyzed in this study; however, since it was conducted eight years before Project Rulison it does provide information on background radiation throughout the state. The geometric mean for beta-gamma activity in groundwater samples collected throughout the state was 17.34 pCi/L while the median and mode were both 14 pCi/L. The arithmetic mean of these groundwater samples was 62.2 pCi/L.

1.6 Rulison Path Forward

In June 2009 the U.S. 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 Rulison test site. 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 the Rulison test site prohibit drilling below a depth of 6,000 feet within the 40-acres known as Lot 11 (NE ¼, SW ¼ Section 25, T7S, R95W) surrounding the Project Rulison site. The depth at which the detonation occurred (8,426 feet bgs) 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, remediated in 1996, as documented in the Rulison Site Surface Report Published in July 1998. Although no feasible technology exists to remove the subsurface radioactive material 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.

The DOE had the Desert Research Institute conduct modeling which calculates potential transport distances from the Rulison site to a hypothetical producing well. The results of the most recent conservative modeling show that wells at the half-mile radius, even in the east-west direction of the natural fracture trend, are safe for gas production. Despite low risks, the DOE recommends a cautious approach to gas development near the Rulison site.

1.7 Radionuclides of Concern

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. 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; where the curie is a unit of radioactivity measurement.

Of the 10,000 curies of tritium produced by the Rulison detonation, 2,824 curies were estimated to have been removed by production testing measurements. 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.

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, 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 Laboratory in Champaign, Illinois has a method detection limit that can measure down to 10 tritium units, or approximately 32 pCi/L. GEL Laboratories in Charleston, South Carolina has a method detection limit that measures tritium activities down to approximately 460 pCi/L.

Today, manmade sources of tritium in the environment include commercial nuclear reactors and research reactors, and government weapons production plants. Self-luminescent exit signs or luminescent gun sights are perhaps more familiar to the public as sources of tritium.

2.0 Natural Gas and Produced Water Sampling

Olsson performed the 2011 sampling of the natural gas and produced water by following the URS RSAP, Revision 3, July 2010. Since there are no Tier I wells within monitoring sector 11; the Furr 16-22B is the closest Tier II well in this sector and is the sentinel Tier II well, the Furr 16-22B was the only well sampled. Non-radionuclide parameters in produced water listed in Table 4 of the RSAP were sampled and analyzed during the 2008 baseline sampling event; however, these parameters were not analyzed in subsequent produced water samples since conversations with URS indicated that the non-radionuclide parameters were only meant for the baseline period.

2.1 Production Sampling

Olsson personnel sampled natural gas and produced water from the Furr 16-22B well on May 23, 2011 and on November 29, 2011 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. The samples were collected from the well separator with the assistance of Laramie Energy II's pumper. Olsson personnel collected the gas sample using a two-stage regulator and by obtaining the gas from the separator. The gas samples were collected in laboratory provided evacuated propane tanks. Olsson collected the produced water samples from the dump line on the separator. The produced water samples were collected in a white 5-gallon plastic bucket equipped with a bottom loading valve rather than directly into laboratory provided plastic bottles as was done in the past so that natural gas condensate could be removed and not submitted to the laboratory in the water samples.

2.2 Natural Gas Sample Analysis

The natural gas samples collected from the Furr 16-22B Tier II well were submitted to Isotech in Champaign, Illinois for gas compositional analysis including carbon-14 (^{14}C) and tritium (^{3}H). Isotech performed the sample preparation and the tritium analysis, but subcontracted the ^{14}C analysis to Beta Analytic Laboratories in Miami, Florida.

The natural gas samples were each 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 (^{3}H) 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 ^{14}C 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 ^{14}C 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 in May 2011 and again in November 2011. These produced water samples were submitted for analysis of radiochemistry parameters 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 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 bottleware.

Produced water sample aliquots were submitted to Isotech (Champaign, IL) and to GEL Laboratory in Charleston, SC 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. Chlorine-36 (^{36}Cl) analysis and Krypton-85 were dropped from the gamma spectroscopy analysis, due to problems with quantifying these radionuclides. Neither of these radionuclides had been detected in previous samples. Therefore, these parameters were not requested to be analyzed per the revised 2010 URS RSAP

Copies of the laboratory reports from Isotech are included as Appendix A, and a copy of the GEL Laboratories report is included as Appendix B. 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 and Furr 16-22D wells and a graph showing the rates of production decline are presented in Appendix C. The radiochemistry data quality review reports prepared by Diane Short & Associates, Inc. are included 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 Isotech results for natural gas samples collected from the Furr 16-22B Tier II gas well from are presented in Table 2. 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 (^{3}H) and carbon-14 (^{14}C).

3.1.1 Tritium Results

The tritium (^{3}H) in the gas samples collected from the Furr 16-22B in May and November 2011 were reported as < 10 tritium units (TU) and < 10.6 TU, respectively. Since the results were reported as '<' indicates that tritium was not detected above the laboratory method detection limits in either of the samples. One TU is equal to 3.19 pCi/L so this corresponds to a detection limit of approximately 31.9 pCi/L.

3.1.2 Carbon-14 Results

The carbon-14 results reported for the gas samples collected from the Furr 16-22B in May 2011 and November 2011 were < 0.7 pMC and < 0.2 pMC, respectively. This indicates that carbon-14 was not detected in either gas sample.

3.2 Produced Water Samples - Radiochemistry Results

The following sections present the laboratory analytical results for the produced water samples collected on May 23, 2011 and November 29, 2011, from the Furr 16-22B gas well. 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 (^{3}H) in the produced water samples submitted from the Furr 16-22 B were each reported as < 10.0 TU which indicates that ^{3}H was not detected. The minimum detectable activity (MDA) that Isotech is able to achieve for ^{3}H 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 produced water samples collected from the Furr 16-22B in May 2011 and November 2011 also indicate that ^{3}H was not detected. The result for the produced water sample collected on May 23, 2011 indicated a ^{3}H result of -153 ± 240 pCi/L, and the result is qualified with a "U" which indicates that tritium was not detected. The detection limit was reported at 461 pCi/L and the laboratory reporting limit was 700 pCi/L. The GEL laboratory results for ^{3}H in the November 29, 2011 produced water sample were reported at -19.6 ± 322 pCi/L, with a detection limit of 601 pCi/L, and a laboratory reporting limit of 700 pCi/L. The result is also qualified with a "U" indicating that ^{3}H was not detected in the sample.

Natural background tritium levels in precipitation typically range from 10 TU to 20 TU (32 pCi/L to 64 pCi/L) and a reasonable upper bound for tritium background activities may be estimated at 100 TU (or approximately 320 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.

3.2.2 Gross Alpha Radiation Results

The GEL Laboratories, LLC (GEL) laboratory results for gross alpha activities show that gross alpha radiation was detected at 39.4 ± 19.9 pCi/L in the May 2011 produced water sample, but was not detected in the produced water sample collected from the Furr 16-22B in November 2011 ("U" 30.7 ± 35.1 pCi/L). The GEL laboratory detection limits for gross alpha radiation were reported as 27.1pCi/L and 58.9 pCi/L, respectively.

The low gross alpha activity detected in the Furr 16-22B sample collected in May 2011 is due to naturally occurring radionuclides associated with high total dissolved solids (TDS) concentrations in the produced water samples. The gross alpha activity is within the expected range of natural background radiation for the

area and is likely due to the presence of naturally occurring uranium, thorium, and their daughter products present in the produced water from the producing formation.

The results for the gross alpha activities in the produced water samples collected from the Furr 16-22B well from 2008 to 2011 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 gross beta activities in the produced water sample collected in May 2011 indicated that gross beta activities were not detected, but that gross beta activities were detected in the produced water sample collected from the Furr 16-22B in November 2011. The laboratory results for the May 2011 produced water sample were reported as 23.8 ± 25.9 pCi/L, qualified with a "U" indicating that gross beta activities were not detected. The detection limit was reported at 43.4 pCi/L. The laboratory results for the November 2011 produced water sample were reported at 42.7 ± 23.6 pCi/L and a detection limit of 37.9 pCi/L.

The gross beta results in the November 2011 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 potassium-40 (^{40}K) or other naturally occurring radionuclides present in sediment entrained in the produced water. The results for the gross beta activities for the 2011 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 either of the produced water samples submitted from the Furr 16-22B well in May and November 2011. The laboratory results show that Strontium-90 (^{90}Sr) results for the May 2011 produced water sample were reported at -0.785 ± 0.605 pCi/L, and a detection limit of 1.26 pCi/L. The ^{90}Sr results for the November 2011 produced water sample were -0.00829 ± 0.677 pCi/L and a detection limit of 1.27 pCi/L. The GEL Laboratories reporting limit for ^{90}Sr was reported at 2.00 pCi/L.

The Technetium-99 (^{99}Tc) results indicated that ^{99}Tc was not detected in either of the produced water samples. The results for ^{99}Tc activities in the May 2011 produced water sample were 11.0 ± 25.1 pCi/L with a detection limit of 43.2 pCi/L, and the ^{99}Tc results for the November 2011 sample was -5.88 ± 21.2 pCi/L with a detection limit of 37.6 pCi/L. The GEL Laboratory reporting limit for ^{99}Tc

was reported at 50.0 pCi/L. The ^{99}Tc activities results are summarized on Table 4 and copies of the laboratory reports are presented in Appendix B.

3.2.5 Chlorine-36 results

The produced water sample collected from the Furr 16-22B on May 25, 2011 was submitted to GEL for analysis of chlorine-36 (^{36}Cl). The results for the analysis of the May 25, 2011 produced water show that ^{36}Cl activities were not detected above the laboratory reporting limits. The URS 2010 Revised RSAP dropped ^{36}Cl from the list of radionuclides since it has not been detected, and since there is matrix interference with the produced water sample ^{36}Cl analysis due to the high dissolved salt concentrations in the produced water. Therefore, the November 2011 sample was not submitted to GEL Laboratories for ^{36}Cl analysis. Previous sample results for ^{36}Cl in samples submitted from the Furr 16-22B have shown that ^{36}Cl was not detected. The results for the ^{36}Cl activities are summarized on Table 4 and copies of the laboratory reports are presented in Appendix B.

According to the January 2005 DOE Rulison Site End State Vision document, the estimated inventory of ^{36}Cl produced by the Rulison detonation was 2.82 curies (Ci), and according to the URS 3rd Quarter 2008 Report, ^{36}Cl is a less common radionuclide in the inventory at Project Rulison.

3.2.6 Gamma-Emitting Radionuclide Results

The results for the gamma-emitting radionuclides analysis show that gamma activities were not detected above laboratory reporting limits in either of the produced water samples submitted in May 2011 or November 2011. 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.

Krypton-85 (^{85}Kr) was included as a radionuclide in the GEL gamma spectroscopy report in May 2011. The results for Krypton-85 have frequently been qualified for the produced water samples as 'UI' for 'uncertain identification' because of the low abundance in the samples. The narrative indicated that the data was rejected for low abundance in the samples submitted from wells Furr 16-22B (-1480 ± 584 pCi/L). Krypton-85 has not previously been detected as a gamma spectroscopy constituent in the samples submitted from the Laramie Energy II wells, or was qualified as 'UI' for low abundance. URS dropped ^{85}Kr from the 2010 Revised URS RSAP in the gamma spectroscopy analysis due to the low relative abundance in the samples.

In addition to Tritium (^{3}H) and Carbon-14 (^{14}C), Krypton-85 (^{85}Kr), an inert gas, is considered as a gas phase radionuclide that potentially could be entrained in the

natural gas. However, the initial activity of ^{85}Kr was estimated at 1,100 curies and the majority of ^{85}Kr was removed during the Project Rulison production tests conducted in 1970-1971. The amount of ^{85}Kr recovered was used to calculate the yield of the Project Rulison device and to estimate the size of the chimney and the cavity. According to the Rulison Path Forward document it is estimated that < 10 curies of ^{85}Kr may have remained in the subsurface by late 2009. Krypton-85 is a weak beta particle emitting radionuclide and has a 10.76 year half-life.

In the May 2011 produced water sample naturally occurring radionuclide results for Actinium-228, Bismuth-214, Lead-214, Radium-228, and Thorium-230 were qualified as "UI" indicating uncertain identification. These are naturally occurring radionuclides.

The gamma spectroscopy results for the November 2011 produced water sample showed that gamma emitting radionuclides were not detected.

3.2.7 Total Uranium Results

The total uranium results for the May 23, 2011 and November 29, 2011 produced water samples show that total uranium was not detected in either sample. Total uranium was not reported at or above the laboratory method detection limit (MDL) of 0.067micrograms per liter (µg/L). The total uranium results are included in Table 4 and copies of the GEL Laboratory reports are presented in Appendix B.

3.3 Data Verification and Validation

The following section presents a summary of the data verification and validation analysis of the Isotech Laboratory Reports (15352, 16947, and 16948) and GEL laboratory reports (278674 and 291078) for samples collected in May 2011 and November 2011. 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 for the tritium analysis performed by both labs, and 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

Isotech performed analysis of tritium and carbon-14 on natural gas samples from the Furr 16-22B and tritium analysis on produced water samples. The standard reports from Isotech did not include QC. However, the raw results and QC for tritium analysis were submitted separately along with the standard reports.

A produced water sample was also submitted to GEL during each sampling event for tritium analysis. 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. Uncertainties were not provided in the reports from Isotech laboratories. However, the raw data provides the uncertainties and the review was conducted using that information.

3.3.2 Isotech and Beta Analytics Gas Analysis Results

Part of the carbon-14 analysis was subcontracted to Beta Analytic Inc. (Beta Analytic) laboratory in Miami, Florida, and QC was not originally provided for the Carbon-14 analysis. Chain-of-custody (COC) documentation was provided between Olsson and Isotech, and from Isotech to Beta Analytic. However, the Beta Analytic COC shows relinquishment to Fedex, but there is no signature for the receipt by Beta Analytic.

On several occasions Olsson requested that Beta Analytic and Isotech provide the signed COC documents; however, the information was not provided. The COC documentation from Olsson to GEL was included in the laboratory report from GEL. The rest of the COC documentation was in order. Email correspondence between Olsson, Isotech, and Beta Analytics is included. On July 5, 2012, Olsson received information from Darden Hood, President of Beta Analytics regarding the carbon-14 analysis of both samples. This information was provided to Diane Short & Associates for their review for preparation of their revised data quality review report dated July 12, 2012.

3.3.3 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.

3.3.4 GEL Results for Total Uranium

The data validation and verification report prepared on February 22, 2012 noted that the GEL Laboratories data packages did not include the raw data for ICP/MS total Uranium. A review of the raw data for total uranium was required by the RSAP. The raw data for these samples was requested from GEL and revised data packages were provided on April 17, 2012 and included 278674_REV01 for the produced water sample collected on 05/23/11, and 291078_REV01 for the produced water sample collected on 11/29/11. These reports were provided to Diane Short & Associates for their review and a revised report was prepared on July 25, 2012 to include the review of the total uranium data.

3.3.5 GEL Results for Gamma Spectroscopy

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

The samples were received at a pH > 2 due to the buffering capacity of the produced water. The laboratory added preservative to bring the sample pH into the acceptance range, which is permissible per 40 CFR Part 141 and has no impact on the results. No qualifiers were added.

Sampling was modified to conform with URS sampling technique of first collecting the produced water samples in a white plastic bucket to allow for visual inspection of the sample and to allow for the removal of free phase hydrocarbons. The bucket is equipped with a bottom loading valve which allows the samples to be collected and for the removal of hydrocarbons.

It was noted that some analytes did not meet the duplicate error ratio (DER) limit values which suggest that the data may be impacted by sample non-homogeneity. A number of the results are qualified with a “UI” or uncertain identification which indicates that these isotope results suffer from type of detection issue and are qualified that they may be biased.

4.0 Summary

The results of the May 23, 2011 and November 29, 2011 sampling of Laramie Energy II's closest Tier II well, the Furr 16-22B, indicate that no radiation related to Project Rulison was detected. The Furr 16-22B Tier II sentinel well is the closest well located in the current RSAP monitoring sectors 11, and since there are no Tier I wells in this sector, the Furr 16-22B is the closest well to the Project Rulison in monitoring sector 11. The location of the Furr 16-22B well is shown on Figure 1 and Figure 2.

Isotech Laboratories indicated that the LP tanks containing the gas samples and the produced water samples submitted for tritium analysis arrived in good condition. GEL laboratories indicated that both of the produced water samples, were bi-phasic, meaning that there was a thick layer of oil (natural gas condensate) floating on top of the water samples. Olsson gave the laboratory permission to remove the oil and analyze only the aqueous portion of the samples as the RSAP requires for Tier II wells. In the future, produced water samples will be collected from the separator dump lines using a five gallon bucket. The bucket will be equipped with a bottom valve assembly and tubing to transfer the produced water into the sample bottles without the natural gas condensate. This sampling technique is consistent with the URS RSAP.

The analytical results show that tritium (^{3}H), reportedly the only radionuclide of concern in the Project Rulison estimated inventory, was not detected in either gas samples or in produced water samples analyzed by Isotech in Champaign, Illinois. Tritium has a 12.3 year half-life and a significant amount of the tritium estimated to have been produced by the detonation was released in 1970 during the production testing of the re-entry well. The DOE estimated amount of Project Rulison related tritium remaining in late 2009 is 700 Curies.

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 well in May and November 2011 show that ^{14}C was not detected (< 0.7 pMC; < 0.2 pMC, respectively). The laboratory results indicate the gas samples have been isolated from modern carbon sources. Carbon-14 is a naturally occurring radionuclide that is found in all animate objects. Carbon-14 has a half-life of 5,730 years. Carbon-14 is commonly used to age date organic materials that are less than 50,000 years old. As of 2010 the estimated inventory of ^{14}C in the Project Rulison site was 2.19 Curies.

Gross alpha activities were reported in the May 23, 2011 produced water sample with a result of 39.4 ± 19.9 pCi/L and the laboratory detection limit was 27.1 pCi/L. Gross alpha activities in the produced water are likely due to high TDS concentrations which were reported in the baseline samples collected in December 2008. Gross alpha activities were not detected at or above the laboratory MDL for the November 29, 2011 produced water sample from the Furr 16-22B well.

Gross beta activities were not detected at or above the laboratory MDL in the May 23, 2011 Furr 16-22B produced water sample. Gross beta activities were reported at 42.7 ± 23.6 pCi/L with a laboratory detection limit of 37.9 pCi/L in the November 29, 2011 Furr 16-22 B produced water sample.

Laboratory analytical results for gross alpha and gross beta indicate activities that are within the range of natural background and these low level activities are most likely due to naturally occurring radionuclides in the Uranium-238 and Thorium-232 decay chain, such as Bismuth-214 (^{214}Bi), Lead-214 (^{214}Pb), and Potassium-40 (^{40}K).

Potassium-40 (^{40}K), one of the most abundant naturally occurring beta emitting radionuclides, has been detected in samples submitted during previous sampling events, including samples from the Furr 16-22B. These results were sometimes qualified with a 'UI', or Uncertain Identification. Gross beta activities may be related to naturally occurring ^{40}K; however, potassium-40 was not detected at or above the laboratory MDL in either the May 2011 or November 2011 produced water sample from the Furr 16-22B well.

The laboratory analytical results indicate that ^{36}Cl, ^{90}Sr, and ^{99}Tc, results were reported as "U" meaning that they were 'not detected' in the May 2011 produced water sample. Olsson did not analyze for ^{36}Cl in the November 2011 produced water sample per changes to the RSAP. The results for total uranium using ICP/MS show that total uranium was not detected in either the May 2011 or November 2011 produced water samples collected from the Furr 16-22B well.

The laboratory analytical results show that gas flow proportional counting of Strontium-90 (^{90}Sr) indicate that ^{90}Sr was not detected at or above the MDL in either of the produced water samples collected in May 2011 or November 2011 from the Furr 16-22B sentinel well. Laboratory results for liquid scintillation counting of Technetium-99 indicate that ^{99}Tc was not detected at or above the MDL in either of the produced water samples collected in May 2011 or November 2011 from the Furr 16-22B Tier II well.

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. Olsson continued to request that the raw data and signed COC from Beta Analytic be provided; however, this information was not provided. The information that was obtained was provided to Diane Short and Associates to review and they amended the data verification and validation report. The revised data verification and validation reports are included as Appendix D.

5.0 References

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TABLES AND FIGURES

TABLE 1

Laramie Energy II - 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 2011 - 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 Sentinel Tier 2 Well
Natural Gas Samples - Laramie Energy II - Rulison Field, Garfield County, Colorado

Well Name/ No.	Sample Source	Latitude/	Longitude	Isotech Job No.	Isotech Lab No.	Sample Name	Date Sample	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		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		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		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		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		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	90.10	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

Note: Shaded rows present the analytical data for the samples collected in 2011 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 Sentinel Tier II Well Production Data
Laramie Energy II, 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	Tritum 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
										NS	NS	4/14/2009	NS	ISO	NS	NS	NS	NS	NS
										11602	165053	6/24/2009	11:55	ISO	< 13.7	< 43.7	N/A	N/A	N/A
										12055	172338	10/1/2009	11:30	ISO	< 10.0	< 31.9	N/A	N/A	N/A
										12373	177011	12/16/2009	13:00	ISO	< 10.0	< 31.9	N/A	N/A	N/A
										13942	196345	10/7/2010	15:00	ISO	< 10.0	< 31.9	N/A	N/A	N/A
										15352	211837	5/23/2011	12:45	ISO	< 10.0	< 31.9	N/A	N/A	N/A
										CORD00100	278674001	5/23/2011	12:45	GEL	N/A	N/A	U	-153	± 240
										16948	228829	11/29/2011	12:25	ISO	< 10.0	< 31.9	N/A	N/A	N/A
										OLSS00111	291078001	11/29/2011	12:25	GEL	N/A	N/A	U	-19.6	± 322

Note: Shaded rows present the results for samples collected in 2011 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 Sentinel Well
Laramie Energy II - 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	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
										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

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 Sentinel Well - 2011 Sample Results
Laramie Energy II - 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	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		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	19.5	-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	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	0.534	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	-4.37	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	-0.472	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

Table presents gamma spectroscopy analytical results for the Furr 16-22B Tier 2 well - 2011 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).

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 Tier II Sentinel Well
Laramie Energy II - 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	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
											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	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	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	UI	U	U	U	U	UI	U	U	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	U
											Result	-36.7	1.63	7.42	1.01	2.58	22.8	-20.8	0.497	-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	3.74	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

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).

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.

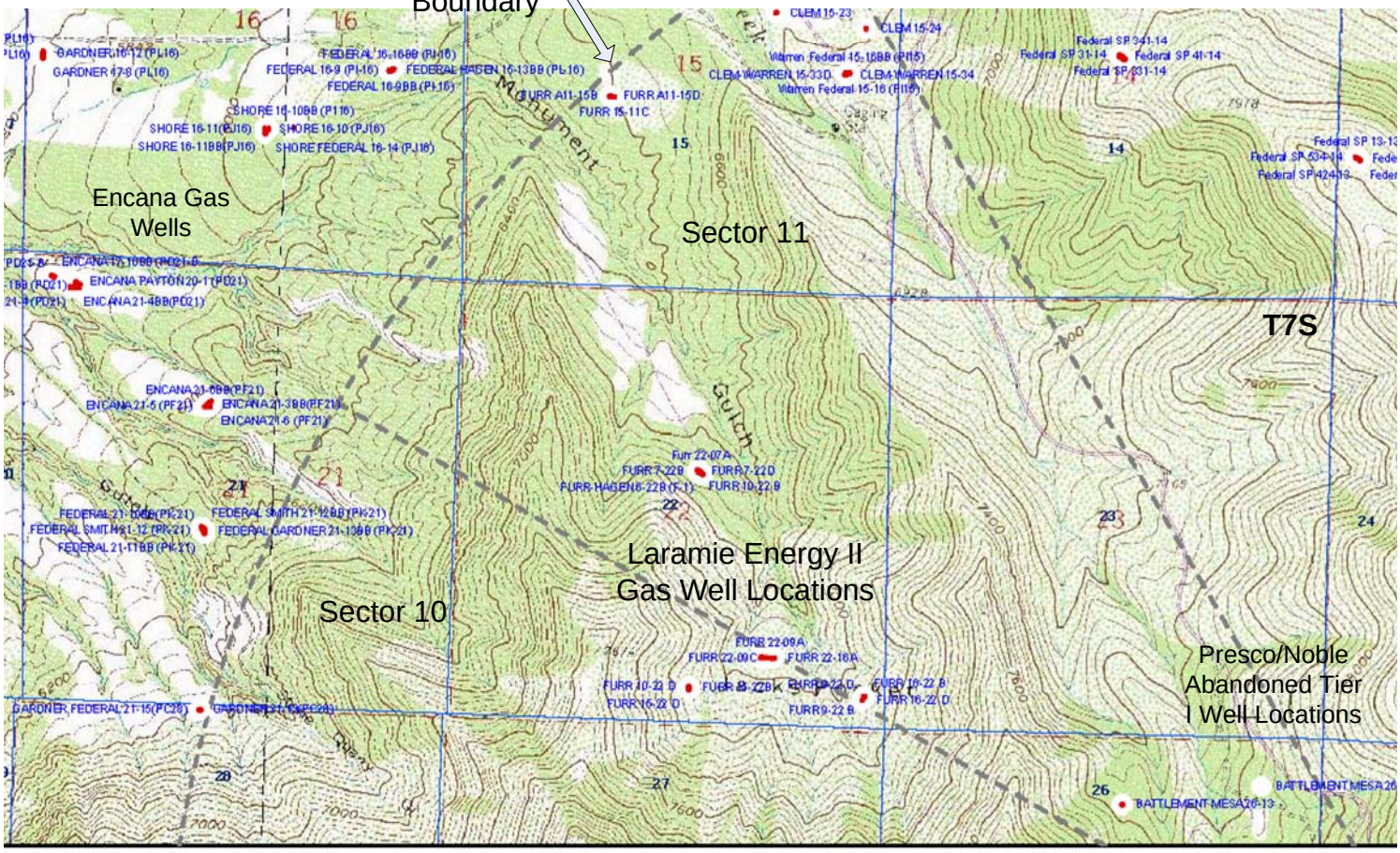
Base Map – USGS Rulison 7.5-minute Quadrangle adapted from the COGCC GIS Database Website

R 95 W

Project Rulison 3-Mile Radius Boundary

Encana Gas Wells

Sector 12



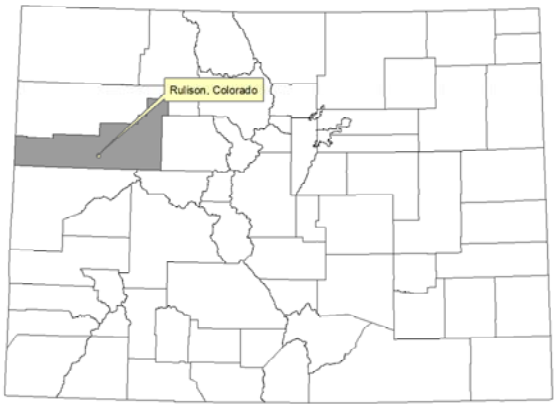
SCALE 1 : 24,042

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

FEET

N

Colorado Index Map



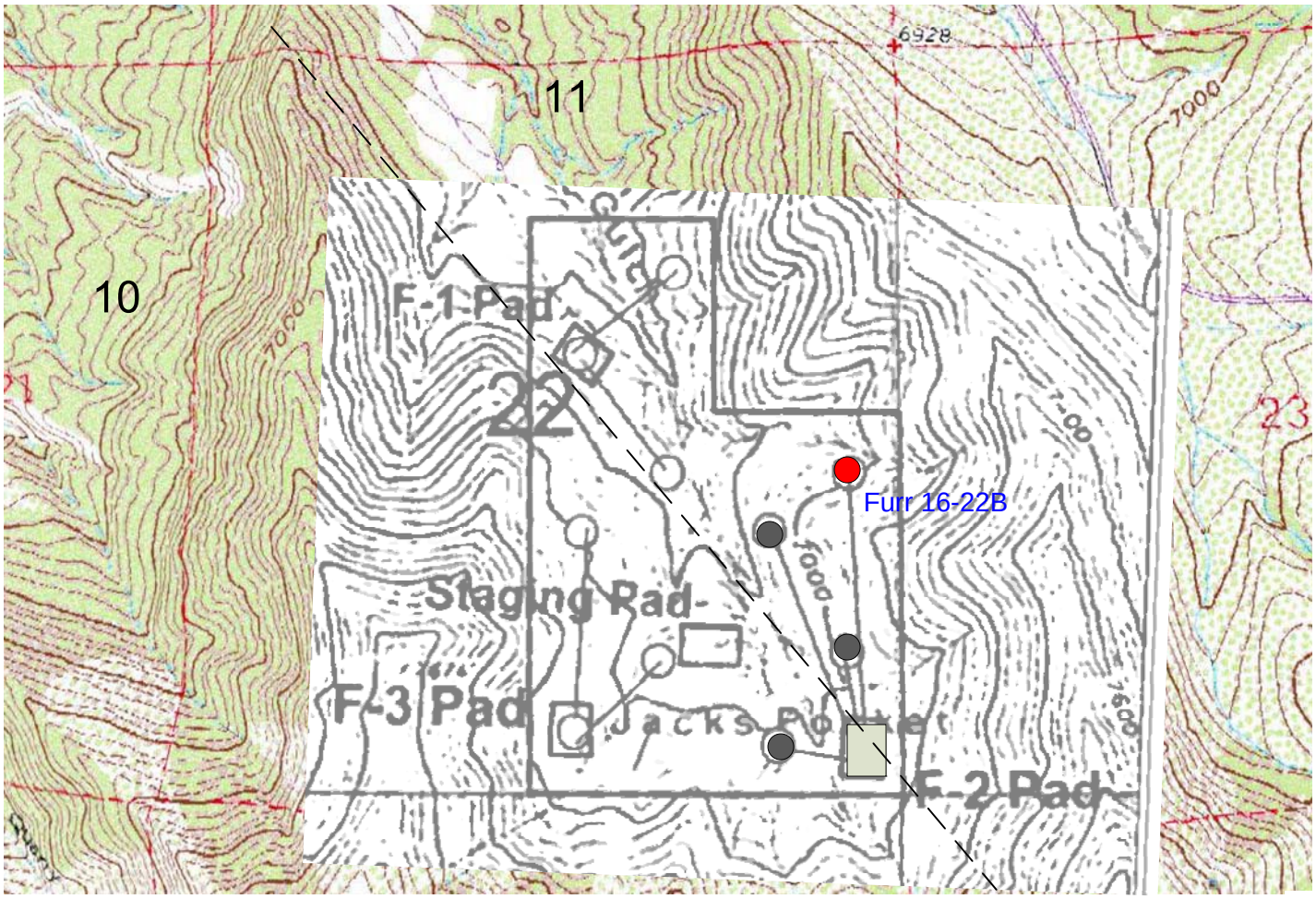
LEGEND:

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)

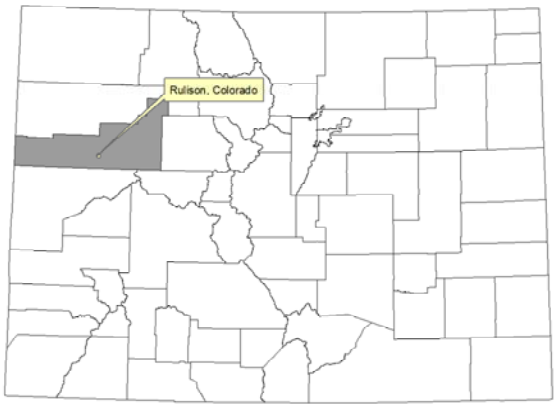
Bottom Hole Locations for other F-2 Pad Wells

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 AND QA/QC PACKAGES

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #:	211832	Job #:	15352
Sample Name/Number:	Furr 16-22B		
Company:	Olsson Associates		
Date Sampled:	5/23/2011	Cylinder:	6051
Container:	LP tank & bottle		
Field/Site Name:	Laramie II - Rulison Area Well Monitoring		
Location:			
Formation/Depth:			
Sampling Point:			
Date Received:	5/25/2011	Date Reported:	6/17/2011

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	^{14}C conc. pMC	Tritium TU
Carbon Monoxide	nd				
Hydrogen Sulfide	nd				
Helium	nd				
Hydrogen	nd				
Argon	na				
Oxygen + Argon	0.037				
Nitrogen	0.22				
Carbon Dioxide	2.96				
Methane	89.36			< 0.7	< 10.0
Ethane	4.91				
Ethylene	nd				
Propane	1.48				
Iso-butane	0.314				
N-butane	0.285				
Iso-pentane	0.106				
N-pentane	0.0792				
Hexanes +	0.251				

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 1070
Specific gravity, calculated: 0.640

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

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Water Analysis

Lab Number: 211837 Job Number: 15352

Submitter Sample Name: Furr 16-22B - H2O

Submitter Sample ID:

Submitter Job #:

Company: Olsson Associates

Field or Site: Laramie II - Rulison Area Well Monitoring

Location:

Depth/Formation:

Container Type: 1 Liter Plastic Bottle

Sample Collected: 5/23/2011 Results Reported: 6/17/2011

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:

ISOTECH

Send Data and Invoice to

Name: James Hix
Company: Olsson Associates
Address: 4690 Table Mountain Dr.
Ste 200, Golden, CO 80403
Phone: 303.237.2072
Fax: 303 237 2072 2659
Email: Jhix@oaconsulting.com

Project: Laramie II - Rulison Area Well Monitoring
Location: Furr Hagen
Sampled by: T. Dobransky

Circle one:
Standard
Priority
Rush

Analysis Package Codes on Back

Isotech Laboratories, Inc.
1308 Parkland Court
Champaign, IL 61821
Phone: 217-398-3490
Fax: 217-398-3493
www.isotechlabs.com
mail@isotechlabs.com

Sample Description

Container Number	Sample Identification	Date Sampled	Time	Analyses Requested: Carbon 14	Analyses Requested: Tritium	Analyses Requested:	Comments
5|A	Furr 16-22B	5/23/11	1245	x	x		* LP Tank - Water Samples to Arrive in Separate Shipments.

Chain-of-Custody Record

	Signature	Company	Date	Time
Relinquished by		Olsson Associates	5/23/11	1700
Received by	Thix, Dwyer	Isotech Labs	5/24/11	1000
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	Analyses & Services Requested: Carbon-14 Analysis	Tritium Enrichment	Tritium Analysis	Tritium Counting Only						Comments
211832		X									Cylinder #2
											No Rush to Return Cylinder, Thx.

Chain of Custody Record

Signature	Company	Date	Time
Relinquished by: Doug Rinder	Shipped via: UPS	5/26/11	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

Send Data and Invoice to

Name: James Hix
Company: Olsson Associates
Address: 4690 Table Mountain Dr.
Ste 200, Golden, CO 80403
Phone: 303.237.2072
Fax: 303 237 2072 2659
Email: Jhix@oaconsulting.com

Project: Laramie II - Rulison Area Well Monitoring
Location: Furr Hagen
Sampled by: T. Dobransky

Circle one:
Standard
Priority
Rush

Analysis Package Codes on Back

Isotech Laboratories, Inc.
1308 Parkland Court
Champaign, IL 61821
Phone: 217-398-3490
Fax: 217-398-3493
www.isotechlabs.com
mail@isotechlabs.com

Sample Description

Container Number	Sample Identification	Date Sampled	Time	Analyses Requested: Carbon 14	Analyses Requested: Tritium	Analyses Requested:	Comments
5IA	Furr 16-22B	5/23/11	1245	X	X		* LP Tank - Water Samples to Arrive in Separate Shipments.

Chain-of-Custody Record

	Signature	Company	Date	Time
Relinquished by		Olsson Associates	5/23/11	1700
Received by		Isotech Labs	5-25-11	0830
Relinquished by				
Received by				
Relinquished by				
Received by				

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #:	228828	Job #:	16947
Sample Name/Number:	Furr 16-22B		
Company:	Olsson Associates		
Date Sampled:	11/29/2011	Cylinder:	6079
Container:	Steel tank		
Field/Site Name:	Laramie II - Rulison Area Well Monitoring		
Location:	Furr Hagen Field		
Formation/Depth:			
Sampling Point:			
Date Received:	12/04/2011	Date Reported:	1/09/2012

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	0.021				
Nitrogen	0.15				
Carbon Dioxide	2.64				
Methane	90.10			< 0.2	< 10.6
Ethane	4.65				
Ethylene	nd				
Propane	1.36				
Propylene	0.0005				
Iso-butane	0.300				
N-butane	0.294				
Iso-pentane	0.130				
N-pentane	0.0935				
Hexanes +	0.257				

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 1072
Specific gravity, calculated: 0.635

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

Water Analysis

Lab Number: 228829 Job Number: 16948

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: 11/29/2011 Results Reported: 1/09/2012

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:

ISOTECH

Send Data and Invoice to

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

Project: Laramie II - Rulison Area Well Monitoring
Location: Furr Hagen Field
Sampled by: TPD

Circle one:
(Standard)
Priority
Rush

Isotech Laboratories, Inc.
1308 Parkland Court
Champaign, IL 61821
Phone: 217-398-3490
Fax: 217-398-3493
www.isotechlabs.com
mail@isotechlabs.com

Analysis Package Codes on Back

Sample Description

Container Number	Sample Identification	Date Sampled	Time	Analyses Requested: Tritium	Analyses Requested: Carbon-14	Analyses Requested:	Comments
79 A	Furr 16-22B	11/29/11	1125	X	X		* Need full QA/QC package *

Chain-of-Custody Record

Signature	Company	Date	Time
Relinquished by	Olsson Associates	11/29/11	1700
Received by	Isotech Labs	11/30/11	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	Analyses & Services Requested: Carbon-14 Analysis	Tritium Enrichment	Tritium Analysis	Tritium Counting Only	Comments
228828	☆	X				Cylinder #5
						No Rush to Return Cylinder Thx

Chain of Custody Record

	Signature	Company	Date	Time
Relinquished by	Doug Rivers	Shipped via UPS	12/6/11	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.

Send Data and Invoice to

Name: JAMES HIX
Company: OLSSON ASSOCIATES
Address: 4690 TABLE MOUNTAIN DRIVE
STE 200, Golden, CO 80403
Phone: 303.237.2072
Fax: 303.237.2659
Email: JHix@olssonsulting.com

Project: LARAMIE II - Wilson Area Well Monitoring
Location: FURR HAGEN FIELD
Sampled by: TPD

Circle one:
(Standard)
Priority
Rush

ISOTECH

Isotech Laboratories, Inc.
1308 Parkland Court
Champaign, IL 61821
Phone: 217-398-3490
Fax: 217-398-3493
www.isotechlabs.com
mail@isotechlabs.com

Sample Description

Analysis Package Codes on Back

Container Number	Sample Identification	Date Sampled	Time	Analyses Requested: TRITIUM			Comments
	FURR 16-22B	11/29/11	1115	X			** NEED FULL QA/QC PACKAGE **

Chain-of-Custody Record

	Signature	Company	Date	Time
Relinquished by		OLSSON ASSOCIATES	11/29/11	1700
Received by		ISOTECH LABS	11/30/11	0900
Relinquished by				
Received by				
Relinquished by				
Received by				

POS	FNCT1	FNCT2	FNCT3	FNCT4	CPMW5	CPMW6	SQPE	SQPI	CPM	CTIME	TIME	DATE	RPT
16	1.59	1.59	1.66	1.74	1.7	3.6	782.16	199.4	3.6	6000	11:48 PM	6/7/2011	1
16	1.5	1.5	1.6	1.7	1.7	3.9	782.98	209.47	3.9	6000	1:29 AM	6/8/2011	2
16	1.43	1.43	1.53	1.58	1.6	3.5	781.95	204.03	3.5	6000	3:10 AM	6/8/2011	3
16	1.93	1.93	2	2.08	2.1	4.3	782.41	204.16	4.3	6000	4:51 AM	6/8/2011	4
16	1.36	1.36	1.47	1.57	1.6	3.6	782.47	208.97	3.6	6000	6:32 AM	6/8/2011	5
16	1.4	1.4	1.5	1.53	1.5	3.4	782.67	208.18	3.4	6000	8:13 AM	6/8/2011	6
16	1.42	1.42	1.5	1.56	1.6	3.9	782.72	220.3	3.9	6000	9:54 AM	6/8/2011	7
16	1.55	1.55	1.62	1.7	1.7	3.8	782.21	204.84	3.8	6000	11:35 AM	6/8/2011	8
16	1.43	1.43	1.54	1.59	1.6	3.6	782.41	206.73	3.6	6000	1:16 PM	6/8/2011	9
16	1.74	1.74	1.78	1.86	1.9	4.2	782	210.89	4.2	6000	2:56 PM	6/8/2011	10
16	1.65	1.65	1.68	1.73	1.7	3.9	781.38	202.65	3.9	6000	4:37 PM	6/8/2011	11
16	1.5	1.5	1.54	1.57	1.6	3.8	782.05	213.38	3.8	6000	6:18 PM	6/8/2011	12
16	1.55	1.55	1.59	1.65	1.7	3.8	782.57	204.56	3.8	6000	7:59 PM	6/8/2011	13
16	1.4	1.4	1.57	1.59	1.6	3.7	782.31	209.69	3.7	6000	9:40 PM	6/8/2011	14
16	1.52	1.52	1.59	1.69	1.7	3.8	782.16	204.12	3.8	6000	11:21 PM	6/8/2011	15
17	24.56	24.57	24.87	25.14	25.1	27.7	782.52	120.49	27.7	6000	1:02 AM	6/9/2011	1
17	24.71	24.73	25.09	25.41	25.4	28.2	781.64	120.7	28.2	6000	2:43 AM	6/9/2011	2
17	24.06	24.08	24.37	24.69	24.7	27.8	781.54	122.74	27.8	6000	4:24 AM	6/9/2011	3
17	23.91	23.96	24.28	24.54	24.5	27.2	781.79	120.88	27.2	6000	6:05 AM	6/9/2011	4
17	23.2	23.21	23.55	23.73	23.7	26.3	782	120.65	26.3	6000	7:45 AM	6/9/2011	5
17	24.34	24.34	24.62	24.8	24.8	27.5	781.59	121.22	27.5	6000	9:26 AM	6/9/2011	6
17	23.93	23.94	24.22	24.42	24.4	27.2	782.1	121.45	27.2	6000	11:07 AM	6/9/2011	7
17	24.58	24.58	24.95	25.22	25.2	28	781.64	121.57	28	6000	12:48 PM	6/9/2011	8
17	24.95	25	25.39	25.72	25.7	28.4	781.9	120.05	28.4	6000	2:29 PM	6/9/2011	9
17	24.11	24.12	24.37	24.57	24.6	27	782.72	118.94	27	6000	4:10 PM	6/9/2011	10
17	23.37	23.39	23.74	24.02	24	26.9	781.69	122.13	26.9	6000	5:51 PM	6/9/2011	11
17	23.33	23.36	23.68	24.05	24	26.8	781.49	121.53	26.8	6000	7:32 PM	6/9/2011	12
17	24.73	24.78	24.95	25.27	25.2	28.2	781.33	122.23	28.2	6000	9:12 PM	6/9/2011	13
17	24.01	24.03	24.33	24.62	24.6	27.1	781.79	120.8	27.1	6000	10:53 PM	6/9/2011	14
17	23.89	23.9	24.11	24.36	24.4	26.9	782.36	119.74	26.9	6000	12:34 AM	6/10/2011	15
18	1.35	1.36	1.46	1.55	1.5	3.6	781.79	202.68	3.6	6000	2:15 AM	6/10/2011	1
18	1.34	1.34	1.41	1.46	1.5	3.4	782.41	206.89	3.4	6000	3:56 AM	6/10/2011	2
18	1.51	1.51	1.53	1.59	1.6	3.6	782.16	204.44	3.6	6000	5:37 AM	6/10/2011	3
18	1.58	1.58	1.62	1.69	1.7	3.9	782.47	205.92	3.9	6000	7:18 AM	6/10/2011	4
18	1.36	1.37	1.47	1.54	1.5	3.5	781.9	209.66	3.5	6000	8:59 AM	6/10/2011	5
18	1.33	1.33	1.37	1.47	1.5	3.5	782.21	208.92	3.5	6000	10:40 AM	6/10/2011	6
18	1.5	1.5	1.6	1.69	1.7	3.7	782.21	209.58	3.7	6000	12:21 PM	6/10/2011	7
18	1.35	1.35	1.43	1.52	1.5	3.5	782.05	206.6	3.5	6000	2:02 PM	6/10/2011	8
18	1.55	1.55	1.61	1.66	1.7	3.8	782.62	209.23	3.8	6000	3:42 PM	6/10/2011	9
18	1.38	1.38	1.43	1.53	1.5	3.7	781.49	212.47	3.7	6000	5:23 PM	6/10/2011	10
18	1.58	1.58	1.61	1.65	1.7	4	782	210.74	4	6000	7:04 PM	6/10/2011	11
18	1.68	1.68	1.73	1.78	1.8	3.7	782.21	202.34	3.7	6000	8:45 PM	6/10/2011	12
18	1.79	1.79	1.87	1.96	2	4	782.1	201.72	4	6000	10:26 PM	6/10/2011	13
18	1.54	1.54	1.65	1.73	1.7	4.1	782.41	213.21	4.1	6000	12:07 AM	6/11/2011	14
18	1.41	1.41	1.53	1.58	1.6	3.5	782.21	203.34	3.5	6000	1:48 AM	6/11/2011	15
19	1.63	1.63	1.71	1.76	1.8	4	781.43	208.32	4	6000	3:29 AM	6/11/2011	1
19	1.43	1.43	1.52	1.55	1.5	3.6	781.38	210.28	3.6	6000	5:10 AM	6/11/2011	2
19	1.33	1.34	1.4	1.43	1.4	3.5	782.41	215.71	3.5	6000	6:51 AM	6/11/2011	3
19	1.6	1.6	1.71	1.78	1.8	4.1	782.21	207.66	4.1	6000	8:32 AM	6/11/2011	4
19	1.36	1.36	1.38	1.46	1.5	3.6	781.64	207.18	3.6	6000	10:13 AM	6/11/2011	5
19	1.65	1.65	1.74	1.82	1.8	4.1	781.64	203.05	4.1	6000	11:53 AM	6/11/2011	6

19	1.38	1.38	1.42	1.49	1.5	3.6	781.85	214.4	3.6	6000	1:34 PM	6/11/2011	7
19	1.55	1.55	1.57	1.58	1.6	3.6	782.16	212.63	3.6	6000	3:15 PM	6/11/2011	8
19	1.5	1.5	1.55	1.64	1.6	3.7	781.64	207.31	3.7	6000	4:56 PM	6/11/2011	9
19	1.56	1.56	1.6	1.67	1.7	3.8	781.79	213.57	3.8	6000	6:37 PM	6/11/2011	10
19	1.37	1.37	1.42	1.52	1.5	3.6	781.38	210.57	3.6	6000	8:18 PM	6/11/2011	11
19	1.51	1.51	1.58	1.68	1.7	3.8	781.79	213.64	3.8	6000	9:59 PM	6/11/2011	12
19	1.46	1.46	1.53	1.58	1.6	3.7	781.95	209.54	3.7	6000	11:40 PM	6/11/2011	13
19	1.41	1.41	1.5	1.58	1.6	3.5	781.59	208.02	3.5	6000	1:21 AM	6/12/2011	14
19	1.5	1.5	1.61	1.75	1.8	3.9	780.82	208.55	3.9	6000	3:01 AM	6/12/2011	15
36	23.53	23.56	23.96	24.2	24.2	26.9	782.26	122.42	26.9	6000	7:10 AM	6/14/2011	1
36	23.55	23.57	23.82	24.17	24.2	27.1	781.59	121.79	27.1	6000	8:50 AM	6/14/2011	2
36	23.25	23.27	23.64	23.89	23.9	26.8	782	122.22	26.8	6000	10:31 AM	6/14/2011	3
36	24.09	24.12	24.56	24.8	24.8	27.3	781.95	119.46	27.3	6000	12:12 PM	6/14/2011	4
36	23.53	23.55	23.85	24.14	24.1	26.9	782.52	122.37	26.9	6000	1:53 PM	6/14/2011	5
36	24.08	24.12	24.28	24.6	24.6	27.6	782.31	122.34	27.6	6000	3:34 PM	6/14/2011	6
36	23.52	23.54	23.82	24.06	24	26.8	782.41	123.04	26.8	6000	5:15 PM	6/14/2011	7
36	23.93	23.96	24.31	24.49	24.5	27.6	780.97	121.37	27.6	6000	6:56 PM	6/14/2011	8
36	23.98	24.02	24.38	24.62	24.6	27.2	782.31	120.03	27.2	6000	8:37 PM	6/14/2011	9
36	24.73	24.74	25.07	25.29	25.3	28	781.23	120.2	28	6000	10:18 PM	6/14/2011	10
36	24.26	24.27	24.55	24.82	24.8	27.5	782.31	120.31	27.5	6000	11:58 PM	6/14/2011	11
36	23	23.05	23.33	23.63	23.6	26	782.1	119.63	26	6000	1:39 AM	6/15/2011	12
36	23.78	23.8	24.09	24.23	24.2	27	782.62	119.69	27	6000	3:20 AM	6/15/2011	13
36	23.85	23.89	24.28	24.47	24.4	27.3	782.41	122.61	27.3	6000	5:01 AM	6/15/2011	14
36	24.4	24.42	24.74	24.96	24.9	27.8	781.02	121.44	27.8	6000	6:42 AM	6/15/2011	15

COUNTER #1

NIST standard calculations			
Standardization date	9/3/1998		
Standardized value	2.00900	Bq/gm	
Date of measurement	6/14/2011		
Value on above date	0.97962	Bq/gm =	8293 TU
Dilution factor	1		
Concentration of dilution	0.97962	Bq/gm =	8292.51 TU

Standard Activity				
Background count rate	1.531	+/-	0.032	cpm
Standard count rate	23.832	+/-	0.126	cpm
Net activity	22.301	+/-	0.130	cpm
Grams of sample	1.995			grams
Net standard activity per gram	11.178	+/-	0.065	cpm/gm
TU/cpm/gm	741.84	+/-	4.32	

Counting efficiency	
total cpm	58.78 TU of std *0.007088
net actvy (cpm/g)	11.178 (std count - bkgrd count) /g
efficiency %	**19.02** net actvy/total dpm std

DATA FILE **89** counter 1
JOB # **15352 CNC**
Count dates: **6-8 through 6-14-11**

Position #	16	17	18	19	36
Sample ID	Blank.	NIST 1.9950 g	211837 DC	211832 DC-C	NIST 1.9950g recount
Cocktail date	3-Jun	3-Jun	3-Jun	3-Jun	3-Jun
Date counted	8-Jun	9-Jun	10-Jun	11-Jun	14-Jun

LABORATORY # 211832

NIST standard calculations			
Standardization date	9/3/1998		
Standardized value	2.00900	Bq/gm	
Date of measurement	6/14/2011		
Value on above date	0.97962	Bq/gm =	8293 TU
Dilution factor	1		
Concentration of dilution	0.97962	Bq/gm =	8292.51 TU

Standard Activity				
Background count rate	1.531	+/-	0.032	cpm
Standard count rate	23.832	+/-	0.126	cpm
Net activity	22.301	+/-	0.130	cpm
Grams of sample	1.995			grams
Net standard activity per gram	11.178	+/-	0.065	cpm/gm
TU/cpm/gm	741.84	+/-	4.32	

Sample Activity				
Background rate	1.531	+/-	0.032	cpm
Sample count rate	1.560	+/-	0.031	cpm
Net activity	0.029	+/-	0.0448	cpm
Grams of sample	10.0357			grams
Net sample activity per gram	0.0029	+/-	0.0045	cpm/gm
TU	2.12	+/-	3.314	

Sample Enrichment			
Initial amount of water	1		
final amount of water	1		
Enrichment factor	1	+/-	0.01
Tf/To	1.00	+/-	0.010
TRITIUM CONC. OF SAMPLE	**2.119**	**+/-**	**3.314 TU**

LABORATORY # 211832
SAMPLE SOURCE: methane

Avg Standard Activity

TU/cpm/gm	**749.53**	**+/-**	**4.33**

Sample Activity				
Background rate	1.550	+/-	0.032	cpm
Sample count rate	1.560	+/-	0.031	cpm
Net activity	0.010	+/-	0.045	cpm
Grams of sample	10.0357			grams
Net sample activity per gram	0.0010	+/-	0.0045	cpm/gm
TU	0.71	+/-	3.363	

Sample Enrichment			
Initial amount of water	1		
final amount of water	1		
Enrichment factor	1	+/-	0.01
Tf/To	1.00	+/-	0.010
TRITIUM CONC. OF SAMPLE	**0.714**	**+/-**	**3.363 TU**

Report < 10.0 TU

LABORATORY # 211837

NIST standard calculations			
Standardization date	9/3/1998		
Standardized value	2.00900	Bq/gm	
Date of measurement	6/14/2011		
Value on above date	0.97962	Bq/gm =	8293 TU
Dilution factor	1		
Concentration of dilution	0.97962	Bq/gm =	8292.51 TU

Standard Activity				
Background count rate	1.531	+/-	0.032	cpm
Standard count rate	23.832	+/-	0.126	cpm
Net activity	22.301	+/-	0.130	cpm
Grams of sample	1.995			grams
Net standard activity per gram	11.178	+/-	0.065	cpm/gm
TU/cpm/gm	741.84	+/-	4.32	

Sample Activity				
Background rate	1.531	+/-	0.032	cpm
Sample count rate	1.560	+/-	0.031	cpm
Net activity	0.029	+/-	0.0448	cpm
Grams of sample	10.0157			grams
Net sample activity per gram	0.0029	+/-	0.0045	cpm/gm
TU	2.12	+/-	3.321	

Sample Enrichment			
Initial amount of water	1		
final amount of water	1		
Enrichment factor	1	+/-	0.01
Tf/To	1.00	+/-	0.010
TRITIUM CONC. OF SAMPLE	**2.123**	**+/-**	**3.321 TU**

LABORATORY # 211837
SAMPLE SOURCE: water

Avg Standard Activity			
TU/cpm/gm	**749.53**	**+/-**	**4.33**

Sample Activity				
Background rate	1.550	+/-	0.032	cpm
Sample count rate	1.560	+/-	0.031	cpm
Net activity	0.010	+/-	0.045	cpm
Grams of sample	10.0157			grams
Net sample activity per gram	0.0010	+/-	0.0045	cpm/gm
TU	0.72	+/-	3.369	

Sample Enrichment			
Initial amount of water	1		
final amount of water	1		
Enrichment factor	1	+/-	0.01
Tf/To	1.00	+/-	0.010
TRITIUM CONC. OF SAMPLE	**0.716**	**+/-**	**3.369 TU**

Report < 10.0 TU

COUNTER 1 **Year 2011-2012**
NIST and BLANK Values

JOB #	ref file	NIST date	count date	Value	+/-	SD	AVG NIST):			BLK date	count date	Value	+/-	SD	AVG BLK :		
new lot cocktail batch, Nov 2011																	
		10-Nov	17-Nov	762.95	+/-	4.52				10-Nov	16-Nov	1.509	+/-	0.032			
										18-Nov	23-Nov	1.523	+/-	0.032	**1.516**	**+/-**	**0.032**
		18-Nov	28-Nov	754.69	+/-	4.46	**758.82**	**+/-**	**4.49**	18-Nov	27-Nov	1.608	+/-	0.033	**1.546**	**+/-**	**0.032**
										2-Dec	5-Dec	1.600	+/-	0.033	**1.560**	**+/-**	**0.032**
		29-Nov	11-Dec	748.55	+/-	4.42	**755.39**	**+/-**	**4.47**	29-Nov	10-Dec	1.482	+/-	0.031	**1.544**	**+/-**	**0.032**
16947, 16948 CNC		13-Dec	19-Dec	755.77	+/-	4.52	**755.49**	**+/-**	**4.48**	13-Dec	19,20-Dec	1.545	+/-	0.029	**1.544**	**+/-**	**0.032**

DATA FILE **104,105** counter 1
JOB # **16947,16948 CNC**
Count dates: **12-18 through 12-22-11**

	104	105			
Position #	13	14	1	2	3
Sample ID	228828 methane	Blank	NIST 1.9812 g	Blank	228829 water
Cocktail date	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Date counted	18-Dec	19-Dec	19-Jan	20-Dec	21-Dec
		counter stopped sensor timeout error		resume count on blank	

POS	CTIME	SQPE	DPM1	**FNCT1**	CLMM	SQPI	RPT	RACK	RACKPOS	FNCT2	FNCT3	FNCT4	RPL	TIME	DATE	CPM	CPMW5	CPMW6
13	6000	783.76	5.50	**1.70**	0.00	206.59	1	0	1	1.70	1.80	1.89	1	10:46 PM	12/17/2011	4.20	1.90	4.20
13	6000	783.14	5.00	**1.62**	0.00	196.83	2	0	1	1.62	1.70	1.78	1	0:27 AM	12/18/2011	3.60	1.80	3.60
13	6000	782.52	4.90	**1.58**	0.00	201.53	3	0	1	1.58	1.68	1.69	1	2:08 AM	12/18/2011	3.60	1.70	3.60
13	6000	783.08	4.30	**1.37**	0.00	216.04	4	0	1	1.37	1.44	1.54	1	3:49 AM	12/18/2011	3.70	1.50	3.70
13	6000	782.77	5.00	**1.66**	0.00	202.60	5	0	1	1.66	1.71	1.75	1	5:30 AM	12/18/2011	3.80	1.80	3.80
13	6000	783.39	5.00	**1.59**	0.00	200.61	6	0	1	1.59	1.69	1.75	1	7:11 AM	12/18/2011	3.70	1.80	3.70
13	6000	783.60	5.60	**1.70**	0.00	196.24	7	0	1	1.70	1.78	1.88	1	8:52 AM	12/18/2011	3.70	1.90	3.70
13	6000	783.60	4.60	**1.46**	0.00	203.93	8	0	1	1.46	1.53	1.60	1	10:33 AM	12/18/2011	3.60	1.60	3.60
13	6000	783.55	5.10	**1.64**	0.00	204.07	9	0	1	1.64	1.72	1.85	1	12:14 PM	12/18/2011	3.80	1.80	3.80
13	6000	783.50	5.10	**1.63**	0.00	204.68	10	0	1	1.63	1.69	1.74	1	1:54 PM	12/18/2011	3.70	1.70	3.70
13	6000	782.00	4.80	**1.51**	0.00	196.19	11	0	1	1.51	1.58	1.64	1	3:35 PM	12/18/2011	3.40	1.60	3.40
13	6000	783.39	5.40	**1.73**	0.00	195.41	12	0	1	1.73	1.81	1.92	1	5:16 PM	12/18/2011	3.80	1.90	3.80
13	6000	783.29	5.50	**1.80**	0.00	199.40	13	0	1	1.80	1.83	1.93	1	6:57 PM	12/18/2011	4.00	1.90	4.00
13	6000	782.41	4.60	**1.53**	0.00	199.96	14	0	1	1.53	1.57	1.62	1	8:38 PM	12/18/2011	3.50	1.60	3.50
13	6000	782.47	4.30	**1.39**	0.00	204.70	15	0	1	1.39	1.43	1.48	1	10:19 PM	12/18/2011	3.50	1.50	3.50
14	6000	782.88	4.40	**1.28**	0.00	210.00	1	0	2	1.28	1.39	1.48	1	0:00 AM	12/19/2011	3.50	1.50	3.50
14	6000	783.81	4.90	**1.56**	0.00	199.77	2	0	2	1.56	1.58	1.64	1	1:41 AM	12/19/2011	3.60	1.60	3.60
14	6000	783.29	4.80	**1.47**	0.00	197.39	3	0	2	1.49	1.61	1.67	1	3:22 AM	12/19/2011	3.40	1.70	3.40
14	6000	782.98	4.70	**1.45**	0.00	205.56	4	0	2	1.45	1.54	1.65	1	5:03 AM	12/19/2011	3.60	1.70	3.60
14	6000	783.45	5.30	**1.69**	0.00	200.57	5	0	2	1.70	1.78	1.89	1	6:43 AM	12/19/2011	4.00	1.90	4.00
14	6000	782.57	5.40	**1.74**	0.00	197.27	6	0	2	1.74	1.83	1.84	1	8:24 AM	12/19/2011	3.80	1.80	3.80
14	6000	783.39	5.10	**1.64**	0.00	201.74	7	0	2	1.64	1.73	1.82	1	10:05 AM	12/19/2011	3.90	1.80	3.90
14	6000	783.19	4.00	**1.30**	0.00	215.06	8	0	2	1.30	1.39	1.43	1	11:46 AM	12/19/2011	3.40	1.40	3.40
14	6000	782.83	4.90	**1.49**	0.00	200.53	9	0	2	1.49	1.60	1.70	1	1:27 PM	12/19/2011	3.60	1.70	3.60
14	6000	783.65	4.60	**1.48**	0.00	209.66	10	0	2	1.48	1.55	1.64	1	3:08 PM	12/19/2011	3.60	1.60	3.60

POS	CTIME	SQPE	DPM1	**FNCT1**	CLMM	SQPI	RPT	RACK	RACKPOS	FNCT2	FNCT3	FNCT4	RPL	TIME	DATE	CPM	CPMW5	CPMW6
1	6000	784.79	60.90	**22.71**	0.00	119.90	1	0	1	22.71	23.01	23.32	1	5:24 PM	12/19/2011	26.00	23.30	26.00
1	6000	782.98	62.60	**22.97**	0.00	118.80	2	0	1	23.00	23.28	23.54	1	7:05 PM	12/19/2011	25.90	23.50	25.90
1	6000	783.14	60.70	**22.33**	0.00	120.59	3	0	1	22.36	22.67	22.89	1	8:46 PM	12/19/2011	25.40	22.90	25.40
1	6000	782.16	62.50	**22.58**	0.00	120.30	4	0	1	22.62	22.98	23.31	1	10:27 PM	12/19/2011	25.80	23.30	25.80
1	6000	782.10	61.60	**22.42**	0.00	121.67	5	0	1	22.45	22.75	23.02	1	0:08 AM	12/20/2011	25.50	23.00	25.50
1	6000	783.14	61.40	**22.38**	0.00	120.76	6	0	1	22.41	22.78	23.10	1	1:49 AM	12/20/2011	25.60	23.10	25.60
1	6000	782.10	63.10	**22.92**	0.00	121.06	7	0	1	22.92	23.18	23.42	1	3:30 AM	12/20/2011	26.10	23.40	26.10
1	6000	783.03	65.40	**23.72**	0.00	119.58	8	0	1	23.72	24.07	24.31	1	5:10 AM	12/20/2011	26.80	24.30	26.80
1	6000	783.50	63.30	**23.07**	0.00	121.25	9	0	1	23.09	23.50	23.76	1	6:51 AM	12/20/2011	26.40	23.70	26.40
1	6000	783.45	61.40	**22.69**	0.00	121.38	10	0	1	22.72	23.11	23.33	1	8:32 AM	12/20/2011	26.00	23.30	26.00
1	6000	783.08	63.10	**23.04**	0.00	120.87	11	0	1	23.07	23.33	23.64	1	10:13 AM	12/20/2011	26.30	23.60	26.30
1	6000	783.34	61.30	**22.24**	0.00	121.14	12	0	1	22.31	22.51	22.90	1	11:54 AM	12/20/2011	25.40	22.80	25.40
1	6000	783.19	61.60	**22.69**	0.00	119.28	13	0	1	22.69	22.94	23.17	1	1:35 PM	12/20/2011	25.40	23.20	25.40
1	6000	782.57	61.70	**22.37**	0.00	121.89	14	0	1	22.38	22.70	22.91	1	3:16 PM	12/20/2011	25.40	22.90	25.40
1	6000	783.45	59.30	**21.82**	0.00	121.38	15	0	1	21.83	22.14	22.43	1	4:56 PM	12/20/2011	25.10	22.40	25.10
2	6000	783.65	5.20	**1.75**	0.00	198.02	1	0	2	1.75	1.82	1.88	1	6:38 PM	12/20/2011	3.80	1.90	3.80
2	6000	783.29	5.90	**1.80**	0.00	198.48	2	0	2	1.80	1.87	1.96	1	8:18 PM	12/20/2011	4.20	2.00	4.20
2	6000	783.55	4.90	**1.59**	0.00	204.74	3	0	2	1.59	1.65	1.73	1	9:59 PM	12/20/2011	3.70	1.70	3.70
2	6000	783.34	4.90	**1.57**	0.00	204.57	4	0	2	1.57	1.64	1.68	1	11:40 PM	12/20/2011	3.70	1.70	3.70
2	6000	783.81	4.60	**1.41**	0.00	212.53	5	0	2	1.41	1.51	1.57	1	1:21 AM	12/21/2011	3.70	1.60	3.70
2	6000	783.03	4.70	**1.54**	0.00	200.73	6	0	2	1.54	1.62	1.69	1	3:02 AM	12/21/2011	3.50	1.70	3.50
2	6000	782.21	4.90	**1.53**	0.00	199.85	7	0	2	1.53	1.62	1.68	1	4:43 AM	12/21/2011	3.60	1.70	3.60
2	6000	782.05	5.20	**1.52**	0.00	209.73	8	0	2	1.52	1.61	1.67	1	6:24 AM	12/21/2011	3.80	1.70	3.80
3	6000	782.21	4.70	**1.50**	0.00	207.58	1	0	3	1.51	1.55	1.61	1	8:55 AM	12/21/2011	3.70	1.60	3.70
3	6000	782.47	4.20	**1.23**	0.00	210.66	2	0	3	1.23	1.29	1.42	1	10:36 AM	12/21/2011	3.30	1.40	3.30
3	6000	782.98	4.20	**1.26**	0.00	208.47	3	0	3	1.26	1.33	1.42	1	12:17 PM	12/21/2011	3.50	1.40	3.50
3	6000	782.31	4.70	**1.56**	0.00	208.40	4	0	3	1.56	1.64	1.73	1	1:58 PM	12/21/2011	3.80	1.70	3.80
3	6000	782.57	4.40	**1.32**	0.00	205.86	5	0	3	1.32	1.41	1.55	1	3:39 PM	12/21/2011	3.60	1.50	3.60
3	6000	783.45	4.90	**1.50**	0.00	202.75	6	0	3	1.50	1.60	1.69	1	5:20 PM	12/21/2011	3.50	1.70	3.50
3	6000	782.52	4.60	**1.41**	0.00	205.05	7	0	3	1.41	1.52	1.59	1	7:01 PM	12/21/2011	3.50	1.60	3.50
3	6000	783.29	4.40	**1.38**	0.00	201.95	8	0	3	1.38	1.47	1.51	1	8:41 PM	12/21/2011	3.40	1.50	3.40
3	6000	783.14	4.60	**1.50**	0.00	208.13	9	0	3	1.50	1.53	1.58	1	10:22 PM	12/21/2011	3.70	1.60	3.70
3	6000	783.39	5.20	**1.51**	0.00	196.96	10	0	3	1.51	1.59	1.69	1	0:03 AM	12/22/2011	3.50	1.70	3.50
3	6000	782.77	5.00	**1.63**	0.00	197.57	11	0	3	1.63	1.71	1.81	1	1:44 AM	12/22/2011	3.60	1.80	3.60
3	6000	782.41	4.20	**1.37**	0.00	192.31	12	0	3	1.37	1.40	1.46	1	3:25 AM	12/22/2011	3.00	1.50	3.00
3	6000	783.34	4.80	**1.43**	0.00	204.48	13	0	3	1.43	1.53	1.59	1	5:06 AM	12/22/2011	3.50	1.60	3.50
3	6000	783.08	4.50	**1.40**	0.00	205.89	14	0	3	1.40	1.51	1.60	1	6:47 AM	12/22/2011	3.40	1.60	3.40
3	6000	782.93	5.00	**1.65**	0.00	201.78	15	0	3	1.65	1.69	1.78	1	8:28 AM	12/22/2011	3.70	1.80	3.70

COUNTER #1

NIST standard calculations				
Standardization date	9/3/1998			
Standardized value	2.00900	Bq/gm		
Date of measurement	12/19/2011			
Value on above date	0.95169	Bq/gm =	8056	TU
Dilution factor	1			
Concentration of dilution	0.95169	Bq/gm =	8056.02	TU

Standard Activity				
Background count rate	1.545	+/-	0.029	cpm
Standard count rate	22.663	+/-	0.123	cpm
Net activity	21.118	+/-	0.126	cpm
Grams of sample	1.9812			grams
Net standard activity per gram	10.659	+/-	0.064	cpm/gm
TU/cpm/gm	755.77	+/-	4.52	

Counting efficiency		
total cpm	57.10	TU of std *0.007088
net actvy (cpm)/g	10.659	(std count - bkgrd count)/g
efficiency %	**18.67**	net actvy/total cpm

APPENDIX B

GEL LABORATORIES LLC

SAMPLE RESULTS AND QA/QC PACKAGES

APPENDIX B – GEL Laboratories Inc. Sample Results and QA/QC Packages

Note: Abridged copies of the GEL Laboratory Reports for laboratory sample Id#278674001 produced water from the Furr 16-22B gas well collected on May 23, 2011 and for 291078001 collected on November 29, 2011 are attached. Please see the CD included in Appendix B for the full laboratory reports and QA/QC Packages.

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: June 10, 2011

Company : Olsson Associates
Address : 4690 Table Mountain Drive
Suite 200
Golden, Colorado 80403
Contact: Mr. James Hix
Project: Olsson Associates - Rulison

Client Sample ID: Furr 16-22B
Sample ID: 278674001
Matrix: water
Collect Date: 23-MAY-11 12:45
Receive Date: 24-MAY-11
Collector: Client

Project: CORD00100
Client ID: CORD001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Liquid "As Received"												
Actinium-228	UI	0.00	+/-12.6	10.1		pCi/L		KXG3	06/08/11	1606	1107663	1
Americium-241	U	-5.86	+/-10.6	14.9		pCi/L						
Antimony-124	U	-1.56	+/-4.97	7.91		pCi/L						
Antimony-125	U	-3.0	+/-4.77	7.68		pCi/L						
Barium-133	U	-0.857	+/-2.43	3.56		pCi/L						
Barium-140	U	-1.63	+/-15.9	24.5		pCi/L						
Beryllium-7	U	-0.133	+/-16.1	27.1		pCi/L						
Bismuth-212	U	19.7	+/-25.9	45.7		pCi/L						
Bismuth-214	UI	0.00	+/-6.61	9.16		pCi/L						
Cerium-139	U	-0.234	+/-1.74	2.91		pCi/L						
Cerium-141	U	3.06	+/-3.87	6.54		pCi/L						
Cerium-144	U	-4.06	+/-11.7	19.5		pCi/L						
Cesium-134	U	0.603	+/-2.04	3.61		pCi/L						
Cesium-136	U	4.49	+/-4.68	8.86		pCi/L						
Cesium-137	U	-0.59	+/-1.75	2.76	5.00	pCi/L						
Chromium-51	U	-1.84	+/-19.9	34.4		pCi/L						
Cobalt-56	U	0.245	+/-1.73	3.01		pCi/L						
Cobalt-57	U	1.78	+/-1.55	2.79		pCi/L						
Cobalt-58	U	-1.29	+/-2.37	3.41		pCi/L						
Cobalt-60	U	-0.0342	+/-1.90	3.10		pCi/L						
Europium-152	U	-2.41	+/-4.99	8.32		pCi/L						
Europium-154	U	-4.18	+/-5.64	8.17		pCi/L						
Europium-155	U	-0.686	+/-6.41	11.0		pCi/L						
Iridium-192	U	0.534	+/-1.93	3.19		pCi/L						
Iron-59	U	1.04	+/-4.25	7.33		pCi/L						
Krypton-85	U	-1480	+/-584	811		pCi/L						
Lead-210	U	-53.1	+/-273	405		pCi/L						
Lead-212	U	4.68	+/-4.82	7.03		pCi/L						
Lead-214	UI	0.00	+/-7.33	6.43		pCi/L						
Manganese-54	U	0.137	+/-1.79	3.08		pCi/L						
Mercury-203	U	-0.999	+/-2.25	3.55		pCi/L						
Neodymium-147	U	-2.06	+/-27.3	45.4		pCi/L						
Neptunium-239	U	1.06	+/-15.8	27.2		pCi/L						
Niobium-94	U	-1.3	+/-1.76	2.64		pCi/L						
Niobium-95	U	-2.06	+/-2.64	3.22		pCi/L						
Potassium-40	U	16.8	+/-29.9	49.6		pCi/L						
Promethium-144	U	0.273	+/-1.87	3.11		pCi/L						
Promethium-146	U	0.391	+/-2.12	3.65		pCi/L						

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Certificate of Analysis

Report Date: June 10, 2011

Company : Olsson Associates
Address : 4690 Table Mountain Drive
Suite 200
Golden, Colorado 80403
Contact: Mr. James Hix
Project: Olsson Associates - Rulison

Client Sample ID: Furr 16-22B
Sample ID: 278674001
Project: CORD00100
Client ID: CORD001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Liquid "As Received"												
Radium-228	UI	0.00	+/-12.6	10.1		pCi/L						
Ruthenium-106	U	1.21	+/-16.3	27.2		pCi/L						
Silver-110m	U	-0.423	+/-1.63	2.61		pCi/L						
Sodium-22	U	-1.48	+/-1.99	2.88		pCi/L						
Thallium-208	U	-0.765	+/-2.32	3.61		pCi/L						
Thorium-230	UI	0.00	+/-885	1050		pCi/L						
Thorium-234	U	83.6	+/-132	169		pCi/L						
Tin-113	U	-0.467	+/-2.24	3.77		pCi/L						
Uranium-235	U	6.55	+/-14.3	21.0		pCi/L						
Uranium-238	U	83.6	+/-132	169		pCi/L						
Yttrium-88	U	0.526	+/-2.20	3.83		pCi/L						
Zinc-65	U	-0.15	+/-4.26	6.40		pCi/L						
Zirconium-95	U	0.279	+/-3.54	6.15		pCi/L						
Rad Gas Flow Proportional Counting												
GFPC, Chlorine-36 liquid "As Received"												
Chlorine-36	U	243	+/-218	363	100	pCi/L		JXR1	06/06/11	1921	1105958	2
GFPC, Gross A/B, liquid "As Received"												
Alpha		39.4	+/-19.9	27.1	5.00	pCi/L		DXF3	05/30/11	1923	1105984	3
Beta	U	23.8	+/-25.9	43.4	5.00	pCi/L						
GFPC, Sr90, liquid "As Received"												
Strontium-90	U	-0.785	+/-0.605	1.26	2.00	pCi/L		JXR1	06/09/11	0828	1105957	4
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Liquid "As Received"												
Tritium	U	-153	+/-240	461	700	pCi/L		EXK2	06/03/11	1132	1108181	5
Liquid Scint Tc99, Liquid "As Received"												
Technetium-99	U	11.0	+/-25.1	43.2	50.0	pCi/L		TYJ1	06/05/11	1620	1106227	6

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Certificate of Analysis

Report Date: June 10, 2011

Company :	Olsson Associates
Address :	4690 Table Mountain Drive Suite 200 Golden, Colorado 80403
Contact:	Mr. James Hix
Project:	Olsson Associates - Rulison

Client Sample ID:	Furr 16-22B	Project:	CORD00100
Sample ID:	278674001	Client ID:	CORD001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 901.1	
2	GL-RAD-A-033	
3	EPA 900.0/SW846 9310	
4	EPA 905.0 Modified	
5	EPA 906.0 Modified	
6	DOE EML HASL-300, Tc-02-RC Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Potassium Chloride Carrier	GFPC, Chlorine-36 liquid "As Received"			76.5	(25%-125%)
Strontium Carrier	GFPC, Sr90, liquid "As Received"			122	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Liquid "As Received"			89.8	(15%-125%)

METALS
–1–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 278674 **METHOD TYPE:** EPA

SAMPLE ID: 278674001 **CLIENT ID:** Furr 16–22B

CONTRACT: CORD00100

MATRIX: water **DATE RECEIVED** 24–MAY–11 **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	110531–1

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Certificate of Analysis

Report Date: December 27, 2011

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	Project:	OLSS00111
Sample ID:	291078001	Client ID:	OLSS001
Matrix:	Water		
Collect Date:	29-NOV-11 11:15		
Receive Date:	30-NOV-11		
Collector:	Client		

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	10.7	+/-23.4	29.7		pCi/L		KXG3	12/27/11	1000	1168747	1
Americium-241	U	1.64	+/-5.21	9.16		pCi/L						
Antimony-124	U	-0.411	+/-7.99	16.1		pCi/L						
Antimony-125	U	-4.37	+/-8.53	14.9		pCi/L						
Barium-133	U	0.757	+/-4.12	6.89		pCi/L						
Barium-140	U	-3.9	+/-16.3	30.4		pCi/L						
Beryllium-7	U	14.4	+/-34.1	65.2		pCi/L						
Bismuth-212	U	22.3	+/-41.0	83.5		pCi/L						
Bismuth-214	U	14.3	+/-9.73	17.3		pCi/L						
Cerium-139	U	-3.2	+/-2.68	4.37		pCi/L						
Cerium-141	U	-0.791	+/-7.79	13.4		pCi/L						
Cerium-144	U	4.61	+/-17.1	31.5		pCi/L						
Cesium-134	U	1.36	+/-3.50	6.95		pCi/L						
Cesium-136	U	8.95	+/-14.8	31.2		pCi/L						
Cesium-137	U	-1.58	+/-4.77	9.48	10.0	pCi/L						
Chromium-51	U	31.3	+/-44.2	86.6		pCi/L						
Cobalt-56	U	-3.09	+/-3.75	6.28		pCi/L						
Cobalt-57	U	0.453	+/-2.29	4.21		pCi/L						
Cobalt-58	U	0.934	+/-3.84	7.52		pCi/L						
Cobalt-60	U	1.08	+/-3.19	6.63		pCi/L						
Europium-152	U	-4.03	+/-9.12	16.3		pCi/L						
Europium-154	U	-1.77	+/-8.74	16.7		pCi/L						
Europium-155	U	3.00	+/-7.98	15.0		pCi/L						
Iridium-192	U	-0.472	+/-3.44	6.35		pCi/L						
Iron-59	U	4.67	+/-8.70	17.7		pCi/L						
Lead-210	U	-36.7	+/-61.9	109		pCi/L						
Lead-212	U	1.63	+/-6.17	10.4		pCi/L						
Lead-214	U	7.42	+/-11.4	15.6		pCi/L						
Manganese-54	U	1.01	+/-3.16	6.22		pCi/L						
Mercury-203	U	2.58	+/-4.21	7.71		pCi/L						
Neodymium-147	U	22.8	+/-104	196		pCi/L						
Neptunium-239	U	-20.8	+/-21.3	36.5		pCi/L						
Niobium-94	U	0.497	+/-2.79	5.42		pCi/L						
Niobium-95	U	-0.42	+/-4.12	7.69		pCi/L						
Potassium-40	U	41.1	+/-65.9	55.0		pCi/L						
Promethium-144	U	-0.663	+/-2.91	5.41		pCi/L						
Promethium-146	U	-0.472	+/-3.51	6.40		pCi/L						
Radium-228	U	10.7	+/-23.4	29.7		pCi/L						

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Certificate of Analysis

Report Date: December 27, 2011

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	Project:	OLSS00111
Sample ID:	291078001	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	17.3	+/-29.3	56.9		pCi/L						
Silver-110m	U	-8.22	+/-3.88	5.60		pCi/L						
Sodium-22	U	-0.694	+/-3.09	5.89		pCi/L						
Thallium-208	U	-2.69	+/-3.77	6.32		pCi/L						
Thorium-234	U	-29.9	+/-69.1	120		pCi/L						
Tin-113	U	-0.336	+/-4.48	7.85		pCi/L						
Uranium-235	U	5.99	+/-18.9	33.3		pCi/L						
Uranium-238	U	-29.9	+/-69.1	120		pCi/L						
Yttrium-88	U	-0.162	+/-3.74	7.67		pCi/L						
Zinc-65	U	-5.33	+/-7.03	11.4		pCi/L						
Zirconium-95	U	0.921	+/-6.32	12.4		pCi/L						
Rad Gas Flow Proportional Counting												
GFPC, Gross A/B, liquid "As Received"												
Alpha	U	30.7	+/-35.1	58.9	5.00	pCi/L		VXC2	12/18/11	1815	1167162	2
Beta		42.7	+/-23.6	37.9	5.00	pCi/L						
GFPC, Sr90, liquid "As Received"												
Strontium-90	U	-0.00829	+/-0.677	1.27	2.00	pCi/L		SYS1	12/26/11	2021	1169136	3
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Liquid "As Received"												
Tritium	U	-19.6	+/-322	601	700	pCi/L		BYS1	12/06/11	1407	1166201	4
Liquid Scint Tc99, Liquid "As Received"												
Technetium-99	U	-5.88	+/-21.2	37.6	50.0	pCi/L		MYM1	12/18/11	1713	1167657	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"			96.7	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Liquid "As Received"			97.8	(15%-125%)

METALS
–1–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 291078 **METHOD TYPE:** EPA

SAMPLE ID: 291078001 **CLIENT ID:** FURR 16–22B

CONTRACT: OLSS00111

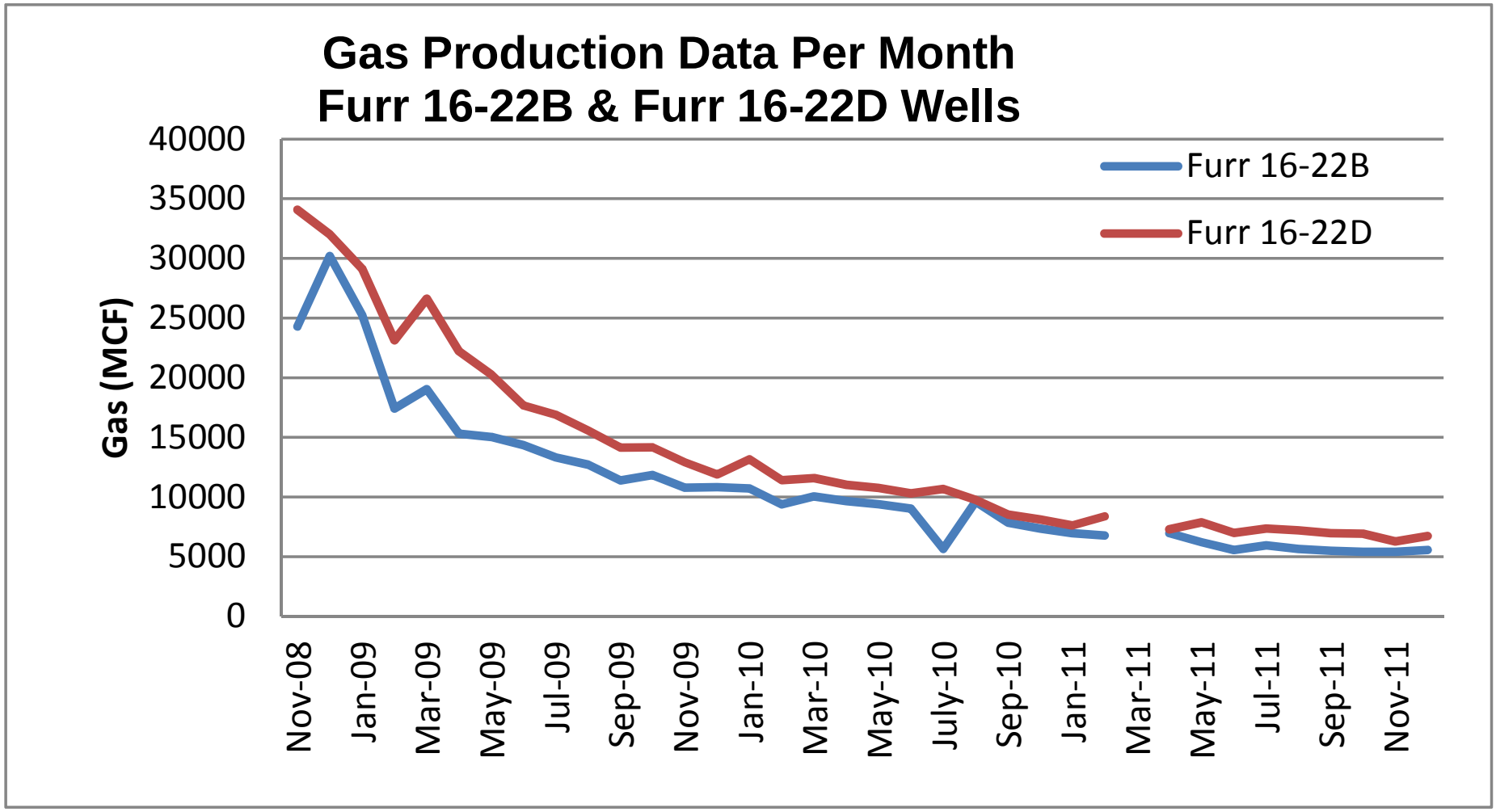
MATRIX: Water **DATE RECEIVED** 30–NOV–11 **LEVEL:** Low **%SOLIDS:**

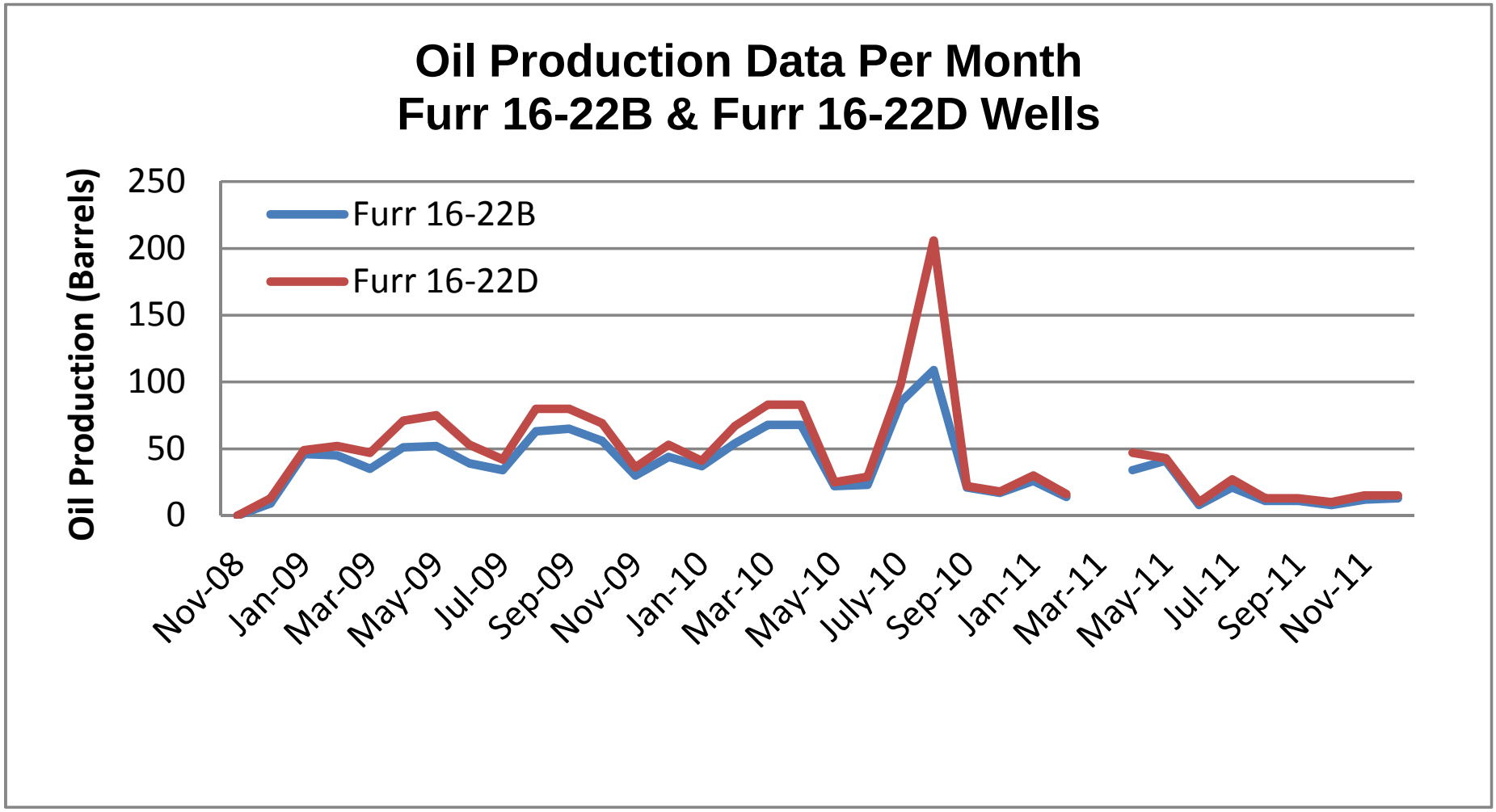
CAS No	Analyte	Result	Units	C	Qual	M*	MDL	DF	Inst ID	Analytical Run
7440–61–1	Uranium	0.067	ug/L	U		MS	0.067	1	ICPMS6	111215–1

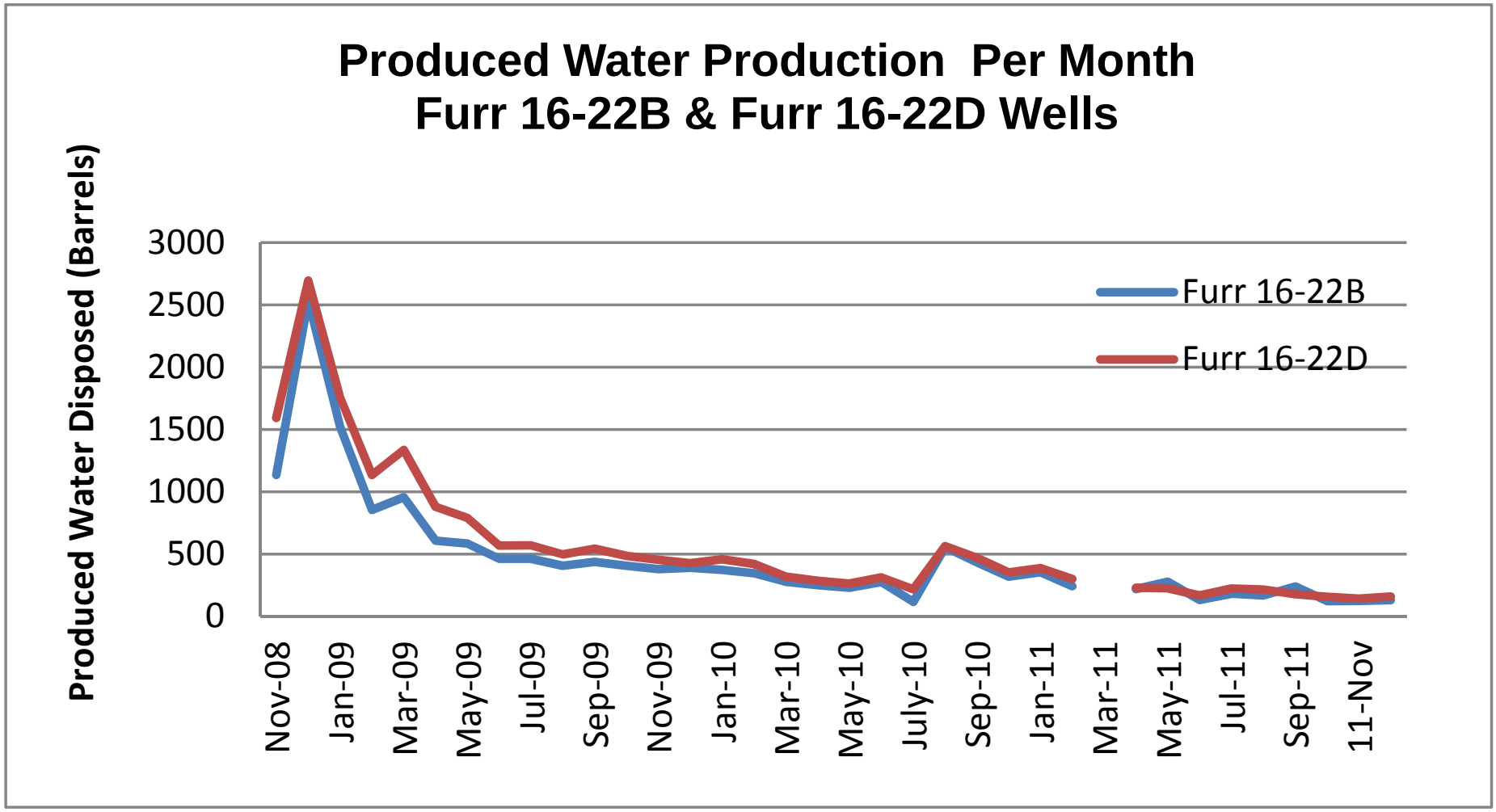
***Analytical Methods:**
P EPA 200.7
MS EPA 200.8
AV EPA 245.1/245.2
AF EPA 1631E

APPENDIX C

Furr 16-22B WELL PRODUCTION DATA GRAPHS


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
Nov-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
Nov-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
11-Nov

COGIS - Monthly Well Production

PRODUCTION DATA REPORT -- GIS

API #:	**05-045-12741**	Location:	**SESE 22 7S 95W 6**
Field:	**PARACHUTE**	Field Code:	**67350**
Facility Name:	**FURR**	Facility #:	**16-22 B**
Operator Name:	**LARAMIE ENERGY II, LLC**	Operator #:	**10232**

PRODUCTION YEAR: All

							OIL						Water Prod	Water (psig)	
							BOM	Produced	Sold	Adj.	EOM	Gravity		Tbg.	Csg.
Year	Month	Formation	Sidetrack	Well Status	Days Prod	Product	GAS						Water Disp. Code	Gas (psig)	
							Prod	Flared	Used	Shrinkage	Sold	BTU		Tbg.	Csg.
2007	Apr	WILLIAMS FORK - CAMEO	00	DG		Oil -> Gas ->									
2007	May	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2007	Jun	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2007	Jul	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2007	Aug	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2007	Sep	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2007	Oct	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2007	Nov	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2007	Dec	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Jan	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Feb	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Mar	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Apr	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	May	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Jun	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Jul	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Aug	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Sep	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Oct	WILLIAMS FORK - CAMEO	00	WO		Oil -> Gas ->									
2008	Nov	WILLIAMS FORK -	00	PR	28	Oil -> Gas ->	24,271	9		398	9 23,873	1,077	1,134 M		

		CAMEO													
2008	Dec	WILLIAMS FORK - CAMEO	00	PR	28	Oil -> Gas ->	9 30,197	86	49	1,062	46 29,135	54.6 1,077	2,541 M		
2009	Jan	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	46 25,263	80	81	847	45 24,416	54.5 1,072	1,523 M		
2009	Feb	WILLIAMS FORK - CAMEO	00	PR	23	Oil -> Gas ->	45 17,410	36	46	337	35 17,073	54.5 1,074	854 M		
2009	Mar	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	35 19,040	60	44	870	51 18,170	56.6 1,075	955 M		
2009	Apr	WILLIAMS FORK - CAMEO	00	PR	29	Oil -> Gas ->	51 15,316	44	43	215	52 15,101	54.9 1,093	606 M		
2009	May	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	52 15,023	28	41	340	39 14,683	53.6 1,092	584 M		
2009	Jun	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	39 14,339	39	44		34 14,339	54.0 1,071	461 M		
2009	Jul	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	34 13,518	73	44	211	63 13,307	53.2 1,067	461 M		
2009	Aug	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	63 12,700	2		296	65 12,404	1,066	406 M		
2009	Sep	WILLIAMS FORK - CAMEO	00	PR	29	Oil -> Gas ->	65 11,389	34	43	143	56 11,246	54.7 1,069	436 M		
2009	Oct	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	56 11,833	58	84	210	30 11,623	54.4 1,068	405 M		
2009	Nov	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	30 10,779	14		307	44 10,472	1,070	379 M		
2009	Dec	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	44 10,823	44	51	415	37 10,408	55.3 1,075	388 M		
2010	Jan	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	37 10,706	17		477	54 10,229	1,068	372 M		
2010	Feb	WILLIAMS FORK - CAMEO	00	PR	28	Oil -> Gas ->	54 9,363	14		362	68 9,001	1,071	345 M		
2010	Mar	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	68 10,047			304	68 9,743	1,060	276 M		
2010	Apr	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	68 9,649	56	102	202	22 9,447	54.2 1,073	249 M		
2010	May	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	22 9,403	1		196	23 9,207	1,065	230 M		
2010	Jun	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	23 9,023	62		352	85 8,671	1,069	274 M		
2010	Jul	WILLIAMS FORK - CAMEO	00	PR	12	Oil -> Gas ->	85 5,639	24		145	109 5,494	1,069	115 M		
2010	Aug	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	109 9,604	11	99	381	21 9,223	54.2 1,076	556 M		
2010	Sep	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	21 7,856	39	43	413	17 7,443	55.1 1,073	433 M		
2010	Oct	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	17 7,350	23	28	243	12 7,107	54.8 1,075	319 M		
2010	Nov	WILLIAMS FORK - CAMEO	00	PR	29	Oil -> Gas ->	12 6,774	21	14	295	19 6,479	55.4 1,075	308 M		
2010	Dec	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	19 6,941	29	22	254	26 6,687	54.6 1,081	363 M		
2011	Jan	WILLIAMS FORK -	00	PR	30	Oil -> Gas ->	26 6,972	2	14	246	14 6,726	55.0 1,050	354 M		

		CAMEO													
2011	Feb	WILLIAMS FORK - CAMEO	00	PR	28	Oil -> Gas ->	14 6,761	41	17	221	38 6,540	55.0 1,074	242 M		
2011	Apr	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	46 6,969	34	39	274	41 6,695	54.8 1,070	219 M		
2011	May	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	41 6,197	2	35	224	8 5,973	54.0 1,065	177 M		
2011	Jun	WILLIAMS FORK - CAMEO	00	PR	29	Oil -> Gas ->	8 5,548	13		198	21 5,350	1,077	132 M		
2011	Jul	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	21 5,955	8	18	209	11 5,746	53.7 1,078	181 M		
2011	Aug	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	11 5,646			193	11 5,453	1,081	168 M		
2011	Sep	WILLIAMS FORK - CAMEO	00	PR	30	Oil -> Gas ->	11 5,485	15	18	185	8 5,300	54.2 1,050	140 M		
2011	Oct	WILLIAMS FORK - CAMEO	00	PR	31	Oil -> Gas ->	8 5,403	19	15	184	12 5,219	54.6 1,078	122 M		

APPENDIX D

DIANE SHORT AND ASSOCIATES

REVISED DATA VERIFICATION AND VALIDATION REPORTS

DIANE SHORT & ASSOCIATES, INC.
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RADIOCHEMISTRY QUALITY REVIEW REPORT
GAMMA SPECTROMETRY

SDG: 278674, 291078

PROJECT: Garfield County CO, Rulison Project for Olsson Assoc. Golden CO

LABORATORY: GEL Laboratories, LLC, Charleston, South Carolina

SAMPLE MATRIX: Water

SAMPLING DATE (Mo/Yr): May 2011 and November 2011

NO.SAMPLES: 2

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 (same sample run on 2 dates)

DATA REVIEWER: John Huntington

QA REVIEWER Diane Short & Associates, Inc. Initials/ Date DLS 02/22/12

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 ___ 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.
278674: Krypton-85 was flagged as "UI" indicating greater uncertainty. However, this analyte was not flagged or detected in samples and no qualification is needed.

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. The detected results with out of limit DER values suggest that the data may be impacted by sample non-homogeneity. These results are qualified as JD#, where # is the DER value, in both the duplicate and the parent sample. Detections agree in both parent and duplicate with the exception of Ra-228 and Ac-228, which were detected in the duplicate but not the parent sample.

Sample	SDG	Analyte	Conc, pCi/L	RL	Count error	Flag	DER	MDC	Qualifier
Furr 16-22B	278674	Ac-228	25.6	14.7	15.1		1.3415	14.7	JD1.34

Sample	SDG	Analyte	Conc, pCi/L	RL	Count error	Flag	DER	MDC	Qualifier
Furr 16-22B	278674	Ba-133	1.15	4.35	2.88	U	1.043	4.35	
Furr 16-22B	278674	Be-7	14.7	37.9	21.0	U	1.1009	37.9	
Furr 16-22B	278674	Ce-144	7.80	26.1	15.6	U	1.1911	26.1	
Furr 16-22B	278674	Co-57	-0.0593	3.37	2.07	U	1.3946	3.37	
Furr 16-22B	278674	Cs-136	-0.898	10.4	6.28	U	1.3495	10.4	
Furr 16-22B	278674	Cs-137	1.43	4.14	2.33	U	1.3566	4.14	
Furr 16-22B	278674	Eu-154	2.50	11.8	6.72	U	1.4939	11.8	
Furr 16-22B	278674	Eu-155	7.62	15.1	8.82	U	1.492	15.1	
Furr 16-22B	278674	Hg-203	-3.55	4.01	3.05	U	1.3195	4.01	
Furr 16-22B	278674	Kr-85	-685	1080	673	U	1.7373	1080	
Furr 16-22B	278674	Mn-54	-1.85	3.17	2.17	U	1.3822	3.17	
Furr 16-22B	278674	Na-22	0.528	4.17	2.43	U	1.2532	4.17	
Furr 16-22B	278674	Nb-94	0.213	3.63	2.15	U	1.0689	3.63	
Furr 16-22B	278674	Nb-95	1.96	4.26	2.35	U	2.2276	4.26	
Furr 16-22B	**278674**	**Ra-228**	**25.6**	**14.7**	**15.1**		**1.3415**	**14.7**	**JD1.34**
Furr 16-22B	278674	Sb-125	3.83	10.5	6.10	U	1.73	10.5	
Furr 16-22B	278674	Th-230	-871	1780	1210	U	2.7508	1780	
Furr 16-22B	278674	Zn-65	-6.26	7.40	5.22	U	1.7776	7.40	
FURR 16-22B	291078	Ac-228	28.0	34.9	20.2	U	1.09682	34.9	
FURR 16-22B	291078	Ag-110m	-1.56	6.69	3.80	U	2.40832	6.69	
FURR 16-22B	291078	Ce-139	0.173	6.01	3.48	U	1.50721	6.01	
FURR 16-22B	291078	Co-56	0.777	7.33	3.85	U	1.40835	7.33	
FURR 16-22B	291078	Cs-137	2.14	7.26	3.73	U	1.20211	7.26	
FURR 16-22B	291078	Eu-152	10.3	17.6	8.87	U	2.21208	17.6	
FURR 16-22B	291078	Eu-155	12.9	22.5	12.1	U	1.34836	22.5	
FURR 16-22B	291078	Fe-59	-3.84	14.8	8.27	U	1.38982	14.8	
FURR 16-22B	291078	Hg-203	-0.999	8.65	4.93	U	1.08143	8.65	
FURR 16-22B	291078	Ir-192	-3.56	6.75	4.03	U	1.13956	6.75	
FURR 16-22B	291078	Nd-117	-165	203	127	U	2.25076	203	
FURR 16-22B	291078	Np-239	20.6	52.8	28.8	U	2.26622	52.8	
FURR 16-22B	291078	Pb-210	-490	1120	686	U	1.28922	1120	
FURR 16-22B	291078	Pb-214	0.00	18.9	14.1	UI	1.5168	18.9	
FURR 16-22B	291078	Pm-144	2.20	6.75	3.46	U	1.23993	6.75	
FURR 16-22B	291078	Ra-228	28.0	34.9	20.2	U	1.09682	34.9	
FURR 16-22B	291078	Ru-106	-13.7	53.2	30.0	U	1.44607	53.2	
FURR 16-22B	291078	Th-234	156	409	288	U	1.23335	409	
FURR 16-22B	291078	Tl-208	1.06	6.98	3.75	U	1.38021	6.98	
FURR 16-22B	291078	U-235	-19.7	39.0	24.2	U	1.64464	39.0	
FURR 16-22B	291078	U-238	156	409	288	U	1.23335	409	
FURR 16-22B	291078	Zn-65	0.220	15.7	8.29	U	1.00054	15.7	

C. If suspected "hot particles" were found, were samples re-analyzed.

Yes____ No __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.

Sample	SDG ID	Analyte	Conc	RL	Count Error	Flag	MDC	Comments
Furr 16-22B	278674	Ac-228	0.00	10.1	12.6	UI	10.1	Data rejected due to high counting uncertainty.
Furr 16-22B	278674	Bi-214	0.00	9.16	6.61	UI	9.16	Data rejected due to low abundance.
Furr 16-22B	278674	Pb-214	0.00	6.43	7.33	UI	6.43	Result not detected above the detection limit
Furr 16-22B	278674	Ra-228	0.00	10.1	12.6	UI	10.1	Result not detected above the detection limit
Furr 16-22B	278674	Th-230	0.00	1050	885	UI	1050	Result not detected above the detection limit

Negative results that have absolute values above the counting error or MDC could potentially indicate a low bias. Such results are qualified as JQ as shown in the table below. Kr-85 has been qualified JQ in SDG 278674 due to this. Kr-85 has been dropped from the QAPP in the 2010 revision and is not a reported target in SDG 291078.

Samp_ID	Method_ID	Parameter	Conc	RL	MDC	Qualifier
FURR 16-22B (278674)	EPA 901.1	Kr-85	-1480	811	811	JQ
FURR 16-22B (291078)	EPA 901.1	Ag-110m	-8.22	5.6	5.6	JQ

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____ No____ NA__X_
This could not be determined from the data provided from GEL. Past reports have indicated the reporting from GEL of decay corrected results with the following comment: "Decay correction is necessary for short half-life isotopes which are not in equilibrium with the parent isotope, thus the measured radionuclide has decayed to a lower level prior to analysis and would require correction back to collection. However, for virtually all isotopes of interest, the isotopes are in equilibrium and the decay is matched by its production from the parent isotope decay. Thus, decay correction would result in a high biased activity." In all reported results in past reported provided to the reviewer, the decay correction did not impact the use of the data, nor the accuracy of the reported result. This would be particularly true of the GEL results which are low level and considered to be 'J' estimated values.

D. Tentatively Identified Radionuclides (TIR)
TIRs were reported and correctly identified from the library search.
Yes____ No_____ N__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 ___ No__X__
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.

The client has changed the sampling procedure to that used by URS. This involves using a dedicated white bucket with a bottom loading valve, designed to allow sample to be collected without the interfering free product which has caused matrix issues in the past.

This is an improvement in the sampling protocol and does not require qualification.

XI. FIELD QC

Field QC samples were identified and have met a guidance limit of CLP 30% for water and 50% for soil, or ± 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 duplicate is present. This is the same sample collected as part of a regular monitoring program and trends over time, and with consideration of seasonal impacts, can be determined as part of assessing matrix precision.

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.

The client has changed the sampling procedure to that used by URS. This involves using a dedicated white bucket with a bottom loading valve, designed to allow sample to be collected without the interfering free product which has caused matrix issues in the past. This is an improvement in the sampling protocol and does not require qualification.

Duplicates

Some analytes did not meet the DER limit, as shown in the table within this report. The non-detected results are acceptable since they are non-detects in both duplicate and parent. The detected results with out of limit DER values suggest that the data may be impacted by sample non-homogeneity. These results are qualified as JD#, where # is the DER value, in both the duplicate and the parent sample. Detections agree in both parent and duplicate with the exception of Ra-228 and Ac-228, which were detected in the duplicate but not the parent sample.

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.
Negative results that have absolute values above the counting error or MDC could potentially indicate a low bias. Such results are qualified as JQ as shown in the table within the body of this report. Kr-85 has been qualified JQ in SDG 278674 due to this. Kr-85 has been dropped from the QAPP in the 2010 revision and is not a reported target in SDG 291078.

Field Duplicates:
No field duplicate is present. This is the same sample collected as part of a regular monitoring program and trends over time, and with consideration of seasonal impacts, can be determined as part of assessing matrix precision.

DIANE SHORT & ASSOCIATES, INC._____

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

SDG: GEL: 278674, 291078

ISOTECH: 15352, 16947, 16948 NOTE: This report has been additionally revised to reflect Beta Analytic information received in June of 2012.

PROJECT: Garfield County CO, Rulison Project for Olsson Assoc. Golden CO

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

SAMPLE MATRIX: Water, Gas

SAMPLING DATE (Mo/Yr): May 2011 and November 2011

NO.SAMPLES: 2 (for tritium, 2 gas samples and 2 water samples)

ANALYSES REQUESTED: GEL: GFPC for Cl-36, gross alpha/beta, and Sr-90; LSC for Tc-99

SAMPLE NUMBERS: FURR 16-22B (same sample collected on 2 different days)

DATA REVIEWER: John Huntington _____

QA REVIEWER: Diane Short & Associates, Inc.____INITIALS/DATE: DLS 11/11/2011;7/25/12

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 ___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. Gross alpha/beta was determined using EPA 900.0, Cl-36 by GL-RAD-A-033, Sr-90 by EPA 905.0, Tc-99 by DOE EML and HASL-300, Tc-02-RC Modified. Cl-36 was only included for SDG 278674 because it was dropped from the list of methods in the 2010 QAPP revision due to high levels of chloride and interference in these samples.

In addition to these data, tritium and C-14 results from IsoTech laboratories was reported. The standard reports from IsoTech include no QC. However, in this case the raw results and QC for tritium analysis were submitted separately along with the standard reports. QC for C-14 was not provided.

C-14 QC: Additional information was received from Beta Analytic in June of 2012. The information consists of two QC reports for samples 211832 and 228828 (lab projects 15352 and 16947, respectively). In addition, printouts of emails between the client , Isotech, and Beta Analytic attempting to obtain QC and signed COC forms from Beta Analytic. Beta Analytic provided the information described above in response to these requests, but COCs signed by Beta Analytic remain unavailable. In addition, there continues to be no raw data provided from Beta Analytic . 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.

The additional information provided by Beta Analytic is represented as including standards associated with the analysis. The association is somewhat vague and no run dates are provided. The report for 16947 states the following:

This report provides the results of reference materials used to validate radiocarbon analyses prior to reporting. Known value reference materials were analyzed quasi-simultaneously with the unknowns. Results are reported as expected values vs measured values. Reported values are calculated relative to NIST SRM-4990B and corrected for isotopic fractionation. Results are reported using the direct analytical measure percent modern carbon (pMC) with one relative standard deviation.

In this report, the results of International Standard FIR-I, as well as for standards identified only as Reference 2, 3, and 4 are provided. All are within acceptance limits. Reference 4 appears to be a background standard.

The report for 15352 states the following:

This report provides the results of reference materials used to validate radiocarbon dating results obtained radiometrically on unknown materials, prior to reporting. Unknowns and reference materials were chemically converted to benzene and then detected for 14C content using liquid scintillation spectrometers.

In this case, the standards are identified as a Primary "hot" calibration standard, which appears to be similar to the FIR-I standard identified in the other report, a chemical purity standard, and background counts taken during the analysis. These are all 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 client has changed the sampling procedure to that used by URS. This involves using a dedicated white bucket with a bottom loading valve, designed to allow sample to be collected without the interfering free product which has caused matrix issues in the past. This is an improvement in the sampling protocol and does not require qualification.

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 ____ No __X__
For samples sent to both Gel and Isotech Laboratories the COC documentation was in order.

The COC between the client and IsoTech laboratories is in order with signatures, properly executed. There is a gap in time due to the Fedex shipment but this is normal.

The COC between IsoTech Laboratories and Beta Analytic was provided, showing the relinquishment to Fedex. However, there was no signature for the receipt by Beta Analytic. This COC is for C-14 analysis. This problem was not corrected in the materials received in June 2012.

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.

SDG 278674, Cl-36: A DER was issued stating that the detection limit could not be met due to matrix interference.

This interference is to be expected in production water samples, which are typically high in chloride. No qualifiers are added since the laboratory has managed the problem appropriately. The 2010 QAPP has removed the requirement for this analysis since Cl-36 has never been detected and suffers severe matrix interference.

Gross Alpha and Beta: There were detections observed for gross alpha or gross beta. The reporting limit is elevated due to matrix. 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 ___ No __X__

The following MS/MSDs were conducted. For the gross alpha/beta analysis, an MS/MSD was conducted. For the other methods, a matrix spike was conducted plus a sample duplicate.

SDG	Method	Client Sample ID	Lab Sample ID
278674	EPA 905.0 Modified (Sr-90)	Furr 16-22B	278674001
	EPA 906.0 Modified (Tritium)	Furr 16-22B	
	GL-RAD-A-033 (Cl-36)	Furr 16-22B	
	EPA 900.0/SW846 9310 (gross alpha/beta)	Furr 16-22B	
	E EML HASL-300, Tc-02-RC Modified	Furr 16-22B	
291078	EPA 905.0 Modified (Sr-90)	Furr 16-22B	291078001
	EPA 906.0 Modified (Tritium)	Furr 16-22B	
	E EML HASL-300, Tc-02-RC Modified	Furr 16-22B	

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

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 ____

3. The samples used for qualification are client samples.
Yes __X_ No___
Except for Isotech which has no MS/MSD.

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 ± RL for results < 5 x RL (± 2x RL for soils).
Yes ____ No __X___ 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 with the exception of the RPD for alpha in SDG 278674, which was 26.3%. No qualifiers are added because the recoveries are in control. The slightly elevated RPD may reflect some matrix inhomogeneity.

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, Cl-36: 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): The additional information received in June 2012 includes background levels. These 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 for Cl-36, 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) and this is reported in the QC reports received in June 2012, for SDG 15352. The chemical purity of the benzene is within acceptance limits. This information was not provided for the other SDG. The 10% review at the raw data level, however, is fulfilled with the data provided for the one QC 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 ___ No____ NA __X__
Field duplicates are not reported. This is the same sample collected as part of a regular monitoring program and trends over time, and with consideration of seasonal impacts, can be determined as part of assessing matrix precision.

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:
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. Gross alpha/beta was determined using EPA 900.0,

Cl-36 by GL-RAD-A-033, Sr-90 by EPA 905.0, Tc-99 by DOE EML and HASL-300, Tc-02-RC Modified. Cl-36 was only included for SDG 278674 because it was dropped from the list of methods in the 2010 QAPP revision due to high levels of chloride and interference in these samples.

In addition to these data, tritium and C-14 results from IsoTech laboratories was reported. The standard reports from IsoTech include no QC. However, in this case the raw results and QC for tritium analysis were submitted separately along with the standard reports. QC for C-14 was not provided.

C-14 QC: Additional information was received from Beta Analytic in June of 2012. The information consists of two QC reports for samples 211832 and 228828 (lab projects 15352 and 16947, respectively). In addition, printouts of emails between the client , Isotech, and Beta Analytic attempting to obtain QC and signed COC forms from Beta Analytic. Beta Analytic provided the information described above in response to these requests, but COCs signed by Beta Analytic remain unavailable. In addition, there continues to be no raw data provided from Beta Analytic . 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.

The additional information provided by Beta Analytic is represented as including standards associated with the analysis. The association is somewhat vague and no run dates are provided. The report for 16947 states the following:

This report provides the results of reference materials used to validate radiocarbon analyses prior to reporting. Known value reference materials were analyzed quasi-simultaneously with the unknowns. Results are reported as expected values vs measured values. Reported values are calculated relative to NIST SRM-4990B and corrected for isotopic fractionation. Results are reported using the direct analytical measure percent modern carbon (pMC) with one relative standard deviation.

In this report, the results of International Standard FIR-I, as well as for standards identified only as Reference 2, 3, and 4 are provided. All are within acceptance limits. Reference 4 appears to be a background standard.

The report for 15352 states the following:

This report provides the results of reference materials used to validate radiocarbon dating results obtained radiometrically on unknown materials, prior to reporting. Unknowns and reference materials were chemically converted to benzene and then detected for 14C content using liquid scintillation spectrometers.

In this case, the standards are identified as a Primary “hot” calibration standard, which appears to be similar to the FIR-I standard identified in the other report, a chemical purity standard, and background counts taken during the analysis. These are all 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 client has changed the sampling procedure to that used by URS. This involves using a dedicated white bucket with a bottom loading valve, designed to allow sample to be collected without the interfering free product which has caused matrix issues in the past. This is an improvement in the sampling protocol and does not require qualification.

Chain of Custody

For samples sent to both Gel and Isotech Laboratories the COC documentation was in order.

The COC between the client and IsoTech laboratories is in order with signatures, properly executed. There is a gap in time due to the Fedex shipment but this is normal.

The COC between IsoTech Laboratories and Beta Analytic was provided, showing the relinquishment to Fedex. However, there was no signature for the receipt by Beta Analytic. This COC is for C-14 analysis. This problem was not corrected in the materials received in June 2012.

Detection and Reporting Limits:

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.

SDG 278674, Cl-36: A DER was issued stating that the detection limit could not be met due to matrix interference. This interference is to be expected in production water samples, which are typically high in chloride. No qualifiers are added since the laboratory has managed the problem appropriately. The 2010 QAPP has removed the requirement for this analysis since Cl-36 has never been detected and suffers severe matrix interference.

Gross Alpha and Beta: There were detections observed for gross alpha or gross beta. The reporting limit is elevated due to matrix. 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.

Matrix Spikes

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

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

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 with the exception of the RPD for alpha in SDG 278674, which was 26.3%. No qualifiers are added because the recoveries are in control. The slightly elevated RPD may reflect some matrix inhomogeneity.

IsoTech has not provided duplicate results for tritium analysis.

Chemical Yield

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) and this is reported in the QC reports received in June 2012, for SDG 15352. The chemical purity of the benzene is within acceptance limits. This information was not provided for the other SDG. The 10% review at the raw data level, however, is fulfilled with the data provided for the one QC set.

DIANE SHORT & ASSOCIATES, INC.
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303:271-9642 Fax 988-4027
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INORGANIC DATA QUALITY REVIEW REPORT
ICPMS-Uranium

SDGs: 278674, 291078 NOTE: This report has been modified to incorporate information received in June, 2012

PROJECT: Garfield County CO, Rulison Project for Olsson Assoc. Golden C

LABORATORY: GEL Laboratories, LLC, Charleston, South Carolina

SAMPLE MATRIX: Water

SAMPLING DATE (Mo/Yr): May 2011 and November 2011 NO.SAMPLES: 2

ANALYSES REQUESTED: Method 200.8 (ICPMS) for uranium

SAMPLE NUMBERS: FURR 16-22B –same sample, two sample dates

DATA REVIEWER: John Huntington

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: DLS 7/25/12

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 _____ No__X__

The following is noted for general clarification:

The rest of the report for this project included all raw data, sufficient for a level IV validation. For the ICPMS, raw data was not present. Internal standards and tunes could not be evaluated. Revised reports were received in June of 2012 for 278674 and 291078. In both cases, the report indicates that the revision was to include raw data for metals analysis. We could not locate ICPMS raw data form 278674, but a full raw data package for ICPMS was present in the package for SDG 291078. Since raw data review is only required for 10% of the data, this satisfies the requirement. The results of that review are incorporated in this report.

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 __X__ No _____

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 _____

Reviewed from SDG 291078.

*And produced a peak width of approximately 0.90 amu at 10% peak height.

Yes __X__ No _____ NA _____

Reviewed from SDG 291078.

*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 _____
Reviewed from SDG 291078.

B. Internal Standardization
*A minimum of three internal standards were present in all standards and blanks at identical levels.
Yes __X__ No _____ NA _____
Reviewed from SDG 291078.

C. Instrument tune.
*The tune check was run.
Yes __X__ No _____ NA _____
Reviewed from SDG 291078.

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 _____
Reviewed from SDG 291078.

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 _____ NA _____

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 _____

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 _____
Reviewed from SDG 291078.

B. Memory interferences
*1. Suitable rinse times were determined prior to sample analysis.
Yes _____ No _____ NA __X__
Data are not available. From the run times in the raw data it is clear that rinse times are typical for this analysis.

*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.

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 _____
278674: The raw results for the CCBs were not provided. The report contains forms for CCBs, which show all values as ND at the MDL of 0.067 ug/L, except for one which had a measured result of 0.108 ug/L. The run date and time for the sample shows that it was run between two CCBs that are in control so this outlier has no impact on the results.

291078: All CCBs are in control, confirmed in the raw data.

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 ____
Reviewed from SDG 291078.

*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 in each SDG. 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 _____

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. This is the same sample collected as part of a regular monitoring program and trends over time, and with consideration of seasonal impacts, can be determined as part of assessing matrix precision.

XIII. OVERALL ASSESSMENT OF THE CASE

The data are considered fully useable for project purposes. No qualifiers have been added.

Deliverables

The rest of the report for this project included all raw data, sufficient for a level IV validation. For the ICPMS, raw data was not present. Internal standards and tunes could not be evaluated. Revised reports were received in June of 2012 for 278674 and 291078. In both cases, the report indicates that the revision was to include raw data for metals analysis. We could not locate ICPMS raw data form 278674, but a full raw data package for ICPMS was present in the package for SDG 291078. Since raw data review is only required for 10% of the data, this satisfies the requirement. The results of that review are incorporated in this report.

Field Duplicate

No field duplicate is reported. This is the same sample collected as part of a regular monitoring program and trends over time, and with consideration of seasonal impacts, can be determined as part of assessing matrix precision.

James Hix

From: Darden Hood <dhood@radiocarbon.com>
Sent: Saturday, May 05, 2012 1:51 PM
To: James Hix
Cc: steve@isotechlabs.com
Subject: FW: Laramie Energy II - Furr 16-22B QA/QC

James, your message was forwarded to me.

I previously forwarded your message on to Steve Pelphrey at Isotech (and again here) for reply.

We work only on a PRIME contract basis, in this case Isotech being the Prime contractor. If you need any information, its really they that need to provide it to you.

Darden Hood
President
Beta Analytic Inc.
4985 SW 74 Court
Miami, Florida 33155 USA
Tel: 305-667-5167, Cel: 305-508-4907
Fax: 305-663-0964, www.radiocarbon.com

BETA is accredited to ISO/IEC 17025:2005 : The highest level of recognized quality attainable by a testing laboratory.

From: soberoi@betalabservices.com [mailto:soberoi@betalabservices.com] **On Behalf Of** Sonia Oberoi
Sent: Friday, May 04, 2012 2:13 PM
To: Darden Hood
Subject: Fwd: Laramie Energy II - Furr 16-22B QA/QC

Hi Darden, please reply. Thanks - Richelle

---------- Forwarded message ----------
From: **James Hix** <jhix@olssonassociates.com>
Date: Sat, May 5, 2012 at 2:05 AM
Subject: Laramie Energy II - Furr 16-22B QA/QC
To: Sonia Oberoi <soberoi@radiocarbon.eu>

Hi Sonia,

I am following up on the status of the QA/QC for the C^{14} analysis on natural gas samples collected from the Furr 16-22B gas well in May and November 2011. The work was subcontracted to BETA Analytic by Isotech.

James

James W. Hix, PG| **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@oaconsulting.com

TEL 303.237.2072 | DIR 303.374.3139 | CELL 303.589.1572 | FAX 303.237.2659

James Hix

From: Pelphrey, Steven R <steve@isotechlabs.com>
Sent: Friday, June 15, 2012 4:25 PM
To: James Hix
Cc: Legner, Christy L
Subject: RE: Laramie Energy II - Furr 16-22B QA/QC

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Regards,
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From: Darden Hood [mailto:dhood@radiocarbon.com]
Sent: Saturday, May 05, 2012 1:51 PM
To: James Hix
Cc: steve@isotechlabs.com
Subject: FW: Laramie Energy II - Furr 16-22B QA/QC

James, your message was forwarded to me.

I previously forwarded your message on to Steve Pelphrey at Isotech (and again here) for reply.

We work only on a PRIME contract basis, in this case Isotech being the Prime contractor. If you need any information, its really they that need to provide it to you.

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James Hix

From: Darden Hood <dhood@radiocarbon.com>
Sent: Thursday, July 05, 2012 3:07 PM
To: James Hix
Cc: steve@isotechlabs.com; legner@isotechlabs.com
Subject: RE: Laramie Energy II - Furr 16-22B QA/QC
Attachments: InstrumentQA_211832.pdf

Jim, here's the other one.
Darden

Darden Hood
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From: James Hix [mailto:jhix@olssonassociates.com]
Sent: Monday, June 18, 2012 4:29 PM
To: Darden Hood
Cc: steve@isotechlabs.com; legner@isotechlabs.com
Subject: FW: Laramie Energy II - Furr 16-22B QA/QC

Darden,

Below is a request for the Instrument QC package we need to complete the report for the 2011 sampling. We need the QC data for carbon-14 analysis for Isotech Job #15352 and #16947 so that we can complete our data validation and submit the report to the State of Colorado.
The COCs from Isotech to Beta Analytic are attached as are the COCs for the samples we submitted to Isotech.

We will be collecting a gas and produced water sample tomorrow from one of the wells for this project and will need the same level of QC data. This will be the only sample that we will need to collect for this project in 2012.
James

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Darden Hood
President

Ron Hatfield
Deputy Director

Chris Patrick
Deputy Director

Quality Assurance Report (Radiometric analysis)

This report provides the results of reference materials used to validate radiocarbon dating results obtained radiometrically on unknown materials, prior to reporting. Unknowns and reference materials were chemically converted to benzene and then detected for ^{14}C content using liquid scintillation spectrometers.

Reference standard results for	Beta-299947
Report date:	June 7, 2011
Submitter:	Dr. Dennis Coleman

Primary “hot” calibration standard

Expected value:	5140 +/- 140
Measured value:	5140 +/- 100
Agreement:	good

Comment: Statistical agreement between the expected and measured values indicates the calibration was accurately calibrated during the sample ^{14}C detection.

Chemical purity standard

Expected value:	4.83 +/- 0.4
Measured value:	4.83 +/- 0.4
Agreement:	good

Comment: Statistical agreement between the expected and measured values indicates the sample benzene was pure. It indicates there was no chemical interference in the measurement of the sample ^{14}C.

Background counts during sample ^{14}C detection

Expected value:	3.70 +/- 0.03
Measured value:	3.72 +/- 0.01
Agreement:	good

Validation: Darden Hood : Date: June 7, 2011

Radiocarbon Dating
Consistent Accuracy
Delivered On-Time

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Mr. Darden Hood
President

Mr. Ronald Hatfield
Mr. Christopher Patrick
Deputy Directors

The Radiocarbon Laboratory Accredited to ISO-17025 Testing Standards (PJLA Accreditation #59423)

Quality Assurance Report

This report provides the results of reference materials used to validate radiocarbon analyses prior to reporting. Known value reference materials were analyzed quasi-simultaneously with the unknowns. Results are reported as expected values vs measured values. Reported values are calculated relative to NIST SRM-4990B and corrected for isotopic fractionation. Results are reported using the direct analytical measure percent modern carbon (pMC) with one relative standard deviation.

Report Date: January 07, 2012
Submitter : Dr. Dennis D. Coleman

QA MEASUREMENTS

FIRI-I (International Standard)	Expected Value:	57.2 +/- 0.3 pMC
	Measured Value:	57.3 +/- 0.3 pMC
	Agreement:	Accepted
Reference 2	Expected Value:	55.7 +/- 0.3 pMC
	Measured Value:	55.8 +/- 0.3 pMC
	Agreement:	Accepted
Reference 3	Expected Value:	97.8 +/- 0.5 pMC
	Measured Value:	97.4 +/- 0.5 pMC
	Agreement:	Accepted
Reference 4	Expected Value:	2.6 +/- 0.2 pMC
	Measured Value:	2.7 +/- 0.1 pMC
	Agreement:	Accepted

COMMENT: All measurements passed acceptance tests.

Validation: Darden Hood Date: January 07, 2012

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	Analyses & Services Requested: Carbon-14 Analysis	Tritium Enrichment	Tritium Analysis	Tritium Counting Only						Comments
211832		X									Cylinder #2
											No Rush to Return Cylinder, Thx.

Chain of Custody Record

Signature	Company	Date	Time
Relinquished by: Doug Rinder	Shipped via: UPS	5/26/11	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.

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	Analyses & Services Requested: Carbon-14 Analysis	Tritium Enrichment	Tritium Analysis	Tritium Counting Only	Comments
228828	☆	X				Cylinder #5
						No Rush to Return Cylinder Thx

Chain of Custody Record

	Signature	Company	Date	Time
Relinquished by	Doug Rivers	Shipped via UPS	12/6/11	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.