**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION III**
**Environmental Sciences Center**
**701 Mapes Road**
**Fort Meade, Maryland 20755-5350**

DATE : March 15, 2012

SUBJECT: Region III Data QA Review

FROM : Fred Foreman, Chief
OASQA Technical Services Branch

TO : Richard M. Fetzer,
Region 3 On-Scene Coordinator

Attached are the gas isotope data from the Dimock Residential Groundwater Site for samples collected January 25th thru January 27, 2012 and submitted to Isotech Laboratories Inc. for analysis. Due to the proprietary nature of the analytical method utilized by Isotech, we are unable to perform a validation of this data.

Samples submitted and analyzed are listed below:

| | | | |
|---|---|---|---|
| HW02z | HW04 | HW05 | HW06 |
| HW08a | HW12 | HW17 | HW24 |
| HW02 | HW01 | HW14 | HW19 |

Please contact me if you have any questions. I may be reached at 410-305-2629 or by email at foreman.fred@epa.gov

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235488 | Job #: | 17407 |
| Sample Name/Number: | HW02z | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/25/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | 0.0112 | | | |
| Hydrogen | nd | | | |
| Argon | 0.628 | | | |
| Oxygen | 0.80 | | | |
| Nitrogen | 40.72 | | | |
| Carbon Dioxide | 0.094 | | | |
| Methane | 57.06 | -29.30 | -160.6 | |
| Ethane | 0.687 | | | |
| Ethylene | nd | | | |
| Propane | nd | | | |
| Propylene | 0.0001 | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -64.6 | -9.66 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 590 Specific gravity, calculated: 0.736

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235489 | Job #: | 17407 |
| Sample Name/Number: | HW04 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/24/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | na | | | |
| Hydrogen | nd | | | |
| Argon | 1.50 | | | |
| Oxygen | 2.28 | | | |
| Nitrogen | 84.37 | | | |
| Carbon Dioxide | 2.01 | | | |
| Methane | 9.76 | -24.98 | -121.8 | |
| Ethane | 0.0796 | | | |
| Ethylene | nd | | | |
| Propane | 0.0004 | | | |
| Propylene | nd | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -63.2 | -9.48 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 100 Specific gravity, calculated: 0.947

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.74
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235490 | Job #: | 17407 |
| Sample Name/Number: | HW05 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/26/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | na | | | |
| Hydrogen | nd | | | |
| Argon | 1.54 | | | |
| Oxygen | 4.82 | | | |
| Nitrogen | 84.97 | | | |
| Carbon Dioxide | 0.40 | | | |
| Methane | 8.24 | -33.0 | -162.9 | |
| Ethane | 0.0259 | | | |
| Ethylene | nd | | | |
| Propane | nd | | | |
| Propylene | nd | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -63.2 | -9.36 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 84 Specific gravity, calculated: 0.948

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.68
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.
** Methane carbon isotopes obtained online via GC-C-IRMS

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235491 | Job #: | 17407 |
| Sample Name/Number: | HW06 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/26/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | 0.0248 | | | |
| Hydrogen | 0.0222 | | | |
| Argon | 0.503 | | | |
| Oxygen | 1.04 | | | |
| Nitrogen | 32.03 | | | |
| Carbon Dioxide | 0.008 | | | |
| Methane | 65.62 | -31.07 | -169.0 | |
| Ethane | 0.746 | | | |
| Ethylene | nd | | | |
| Propane | 0.0068 | | | |
| Propylene | 0.0001 | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -65.6 | -9.85 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 678 Specific gravity, calculated: 0.700

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235492 | Job #: | 17407 |
| Sample Name/Number: | HW08a | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/25/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | na | | | |
| Hydrogen | nd | | | |
| Argon | 0.746 | | | |
| Oxygen | 5.31 | | | |
| Nitrogen | 36.31 | | | |
| Carbon Dioxide | 3.22 | | | |
| Methane | 53.64 | -36.58 | -209.9 | |
| Ethane | 0.767 | | | |
| Ethylene | nd | | | |
| Propane | 0.0030 | | | |
| Propylene | nd | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -61.0 | -9.20 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 557 Specific gravity, calculated: 0.774

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.67
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235493 | Job #: | 17407 |
| Sample Name/Number: | HW12 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/26/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | 0.0434 | | | |
| Hydrogen | nd | | | |
| Argon | 0.115 | | | |
| Oxygen | 0.16 | | | |
| Nitrogen | 4.54 | | | |
| Carbon Dioxide | 0.073 | | | |
| Methane | 94.06 | -35.90 | -196.7 | |
| Ethane | 0.987 | | | |
| Ethylene | nd | | | |
| Propane | 0.0221 | | | |
| Propylene | 0.0002 | | | |
| Iso-butane | 0.0006 | | | |
| N-butane | 0.0012 | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -64.6 | -9.60 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 972 Specific gravity, calculated: 0.580

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235494 | Job #: | 17407 |
| Sample Name/Number: | HW17 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/27/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | na | | | |
| Hydrogen | nd | | | |
| Argon | 1.49 | | | |
| Oxygen | 2.06 | | | |
| Nitrogen | 80.93 | | | |
| Carbon Dioxide | 0.43 | | | |
| Methane | 14.97 | -31.54 | -167.8 | |
| Ethane | 0.118 | | | |
| Ethylene | nd | | | |
| Propane | 0.0011 | | | |
| Propylene | nd | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -64.9 | -9.63 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 154 Specific gravity, calculated: 0.917

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.72
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235495 | Job #: | 17407 |
| Sample Name/Number: | HW24 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/27/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | na | | | |
| Hydrogen | nd | | | |
| Argon | 1.58 | | | |
| Oxygen | 1.29 | | | |
| Nitrogen | 94.00 | | | |
| Carbon Dioxide | 0.017 | | | |
| Methane | 3.11 | -53.8 | -165 | |
| Ethane | nd | | | |
| Ethylene | nd | | | |
| Propane | nd | | | |
| Propylene | nd | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -64.8 | -9.70 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 31 Specific gravity, calculated: 0.963

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.65
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.
** Methane isotopes obtained online via the GC-C-IRMS

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235496 | Job #: | 17407 |
| Sample Name/Number: | HW02 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/25/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | 0.0110 | | | |
| Hydrogen | nd | | | |
| Argon | 0.636 | | | |
| Oxygen | 1.12 | | | |
| Nitrogen | 41.09 | | | |
| Carbon Dioxide | 0.10 | | | |
| Methane | 56.36 | -29.36 | -160.5 | |
| Ethane | 0.683 | | | |
| Ethylene | nd | | | |
| Propane | nd | | | |
| Propylene | 0.0001 | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -64.5 | -9.76 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 583 Specific gravity, calculated: 0.739

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235497 | Job #: | 17407 |
| Sample Name/Number: | HW01 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/25/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | 0.0747 | | | |
| Hydrogen | nd | | | |
| Argon | 0.683 | | | |
| Oxygen | 0.20 | | | |
| Nitrogen | 49.91 | | | |
| Carbon Dioxide | 0.005 | | | |
| Methane | 48.69 | -36.80 | -202.4 | |
| Ethane | 0.432 | | | |
| Ethylene | nd | | | |
| Propane | 0.0004 | | | |
| Propylene | 0.0001 | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -65.1 | -9.81 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 501 Specific gravity, calculated: 0.769

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235498 | Job #: | 17407 |
| Sample Name/Number: | HW14 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/26/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | na | | | |
| Hydrogen | nd | | | |
| Argon | 1.46 | | | |
| Oxygen | 2.70 | | | |
| Nitrogen | 72.02 | | | |
| Carbon Dioxide | 4.99 | | | |
| Methane | 18.74 | -26.58 | -140.3 | |
| Ethane | 0.0899 | | | |
| Ethylene | nd | | | |
| Propane | nd | | | |
| Propylene | nd | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -63.2 | -9.54 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 191 Specific gravity, calculated: 0.927

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.74
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# ANALYSIS REPORT

| | | | |
|---|---|---|---|
| Lab #: | 235499 | Job #: | 17407 |
| Sample Name/Number: | HW19 | | |
| Company: | TechLaw, Inc. | | |
| Date Sampled: | 1/23/2012 | | |
| Container: | Dissolved Gas Bottle | | |
| Field/Site Name: | A3TA | | |
| Location: | | | |
| Formation/Depth: | | | |
| Sampling Point: | | | |
| Date Received: | 2/03/2012 | Date Reported: | 2/20/2012 |

| Component | Chemical mol. % | $\delta^{13}C$ ‰ | $\delta D$ ‰ | $\delta^{18}O$ ‰ |
|---|---|---|---|---|
| Carbon Monoxide | nd | | | |
| Hydrogen Sulfide | na | | | |
| Helium | na | | | |
| Hydrogen | nd | | | |
| Argon | 1.63 | | | |
| Oxygen | 7.11 | | | |
| Nitrogen | 86.88 | | | |
| Carbon Dioxide | 4.38 | | | |
| Methane | 0.0011 | | | |
| Ethane | nd | | | |
| Ethylene | nd | | | |
| Propane | nd | | | |
| Propylene | nd | | | |
| Iso-butane | nd | | | |
| N-butane | nd | | | |
| Iso-pentane | nd | | | |
| N-pentane | nd | | | |
| Hexanes + | nd | | | |
| Water | | | -61.1 | -9.13 |

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 0 Specific gravity, calculated: 1.008

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.73
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which 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. %.

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# Isotech Gas Data

Job 17407

| Isotech Lab No. | Sample Name | Sample Date | Sample Time | Field Name | GC Date | He % | $H_2$ % | Ar % | $O_2$ % | $CO_2$ % | $N_2$ % | CO % | $C_1$ % | $C_2$ % | $C_2H_4$ % | $C_3$ % | $C_3H_6$ % | $iC_4$ % | $nC_4$ % | $iC_5$ % | $nC_5$ % | $C_6$+ % | MS Date | $\delta^{13}C_1$ ‰ | $\delta DC_1$ ‰ | $\delta D\ H_2O$ ‰ | $\delta^{18}O\ H_2O$ ‰ | Specific Gravity | BTU | Helium dilution factor * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 235488 | HW02z | 1/25/2012 | 12:59 | A3TA | 2/9/2012 | 0.0112 | nd | 0.628 | 0.80 | 0.094 | 40.72 | nd | 57.06 | 0.687 | nd | nd | 0.0001 | nd | nd | nd | nd | nd | 2/10/2012 | -29.30 | -160.6 | -64.6 | -9.66 | 0.736 | 590 | |
| 235489 | HW04 | 1/24/2012 | 14:33 | A3TA | 2/9/2012 | na | nd | 1.50 | 2.28 | 2.01 | 84.37 | nd | 9.76 | 0.0796 | nd | 0.0004 | nd | nd | nd | nd | nd | nd | 2/10/2012 | -24.98 | -121.8 | -63.2 | -9.48 | 0.947 | 100 | 0.74 |
| 235490 | HW05 | 1/26/2012 | 11:35 | A3TA | 2/9/2012 | na | nd | 1.54 | 4.82 | 0.40 | 84.97 | nd | 8.24 | 0.0259 | nd | nd | nd | nd | nd | nd | nd | nd | 2/13/2012 | -33.0 | -162.9 | -63.2 | -9.36 | 0.948 | 84 | 0.68 |
| 235491 | HW06 | 1/26/2012 | 15:30 | A3TA | 2/9/2012 | 0.0248 | 0.0222 | 0.503 | 1.04 | 0.008 | 32.03 | nd | 65.62 | 0.746 | nd | 0.0068 | 0.0001 | nd | nd | nd | nd | nd | 2/11/2012 | -31.07 | -169.0 | -65.6 | -9.85 | 0.700 | 678 | |
| 235492 | HW08a | 1/25/2012 | 11:46 | A3TA | 2/9/2012 | na | nd | 0.746 | 5.31 | 3.22 | 36.31 | nd | 53.64 | 0.767 | nd | 0.0030 | nd | nd | nd | nd | nd | nd | 2/11/2012 | -36.58 | -209.9 | -61.0 | -9.20 | 0.774 | 557 | 0.67 |
| 235493 | HW12 | 1/26/2012 | 13:23 | A3TA | 2/9/2012 | 0.0434 | nd | 0.115 | 0.16 | 0.073 | 4.54 | nd | 94.06 | 0.987 | nd | 0.0221 | 0.0002 | 0.0006 | 0.0012 | nd | nd | nd | 2/11/2012 | -35.90 | -196.7 | -64.6 | -9.60 | 0.580 | 972 | |
| 235494 | HW17 | 1/27/2012 | 11:40 | A3TA | 2/9/2012 | na | nd | 1.49 | 2.06 | 0.43 | 80.93 | nd | 14.97 | 0.118 | nd | 0.0011 | nd | nd | nd | nd | nd | nd | 2/11/2012 | -31.54 | -167.8 | -64.9 | -9.63 | 0.917 | 154 | 0.72 |
| 235495 | HW24 | 1/27/2012 | 12:09 | A3TA | 2/9/2012 | na | nd | 1.58 | 1.29 | 0.017 | 94.00 | nd | 3.11 | nd | nd | nd | nd | nd | nd | nd | nd | nd | 2/13/2012 | -53.8 | 165 | -64.8 | -9.70 | 0.963 | 31 | 0.65 |
| 235496 | HW02 | 1/25/2012 | 12:58 | A3TA | 2/9/2012 | 0.0110 | nd | 0.636 | 1.12 | 0.10 | 41.09 | nd | 56.36 | 0.683 | nd | nd | 0.0001 | nd | nd | nd | nd | nd | 2/11/2012 | -29.36 | -160.5 | -64.5 | -9.76 | 0.739 | 583 | |
| 235497 | HW01 | 1/25/2012 | 16:31 | A3TA | 2/9/2012 | 0.0747 | nd | 0.683 | 0.20 | 0.005 | 49.91 | nd | 48.69 | 0.432 | nd | 0.0004 | 0.0001 | nd | nd | nd | nd | nd | 2/11/2012 | -36.80 | -202.4 | -65.1 | -9.81 | 0.769 | 501 | |
| 235498 | HW14 | 1/26/2012 | 17:13 | A3TA | 2/9/2012 | na | nd | 1.46 | 2.70 | 4.99 | 72.02 | nd | 18.74 | 0.0899 | nd | nd | nd | nd | nd | nd | nd | nd | 2/11/2012 | -26.58 | -140.3 | -63.2 | -9.54 | 0.927 | 191 | 0.74 |
| 235499 | HW19 | 1/23/2012 | 15:47 | A3TA | 2/9/2012 | na | nd | 1.63 | 7.11 | 4.38 | 86.88 | nd | 0.0011 | nd | nd | nd | nd | nd | nd | nd | nd | nd | 2/7/2012 | * | * | -61.1 | -9.13 | 1.008 | 0 | 0.73 |

* Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace.
Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.
*** Isotopes obtained online via GC-C-IRMS*
*** Methane concentration insufficient for isotope analyses

nd = not detected, na = not analyzed