

Gasbuggy, New Mexico, Natural Gas and Produced Water Sampling and Analysis Results for 2013

December 2013

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Gas Sample Location

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1.0 Introduction

The U.S. Department of Energy (DOE) Office of Legacy Management conducted natural gas sampling for the Gasbuggy, New Mexico, Site on June 18 and 19, 2013. This monitoring of natural gas includes samples of produced water from gas production wells that are located near the site. Water samples from gas production wells were analyzed for gamma-emitting radionuclides, gross alpha, gross beta, and tritium. Natural gas samples were analyzed for tritium and carbon-14. ALS Laboratory Group in Fort Collins, Colorado, analyzed water samples. Isotech Laboratories in Champaign, Illinois, analyzed natural gas samples.

2.0 Site Location and Background

The Gasbuggy site comprises 640 acres in Rio Arriba County, New Mexico, approximately 55 miles east of the city of Farmington and approximately 21 miles southwest of the town of Dulce, in the Carson National Forest (see Figure 1). As part of the Plowshare program, one underground nuclear detonation was conducted at the Gasbuggy site on December 10, 1967, in an effort to stimulate natural gas production in the gas-bearing Pictured Cliffs Formation. The detonation took place at a depth of 4,240 feet below ground surface, approximately 40 feet below the Pictured Cliffs Sandstone/Lewis Shale contact. The detonation had an estimated yield of 29 kilotons.

There are no wells, springs, surface water, or gas wells onsite. All sampling locations are off of the Gasbuggy site proper. Seven offsite natural gas production wells were sampled during this event. Gas sample locations (see attached map) range from 1 mile to 1.7 miles from the emplacement hole, also known as surface ground zero (SGZ). All seven of the gas wells sampled are perforated for gas production from the Pictured Cliffs Formation, the same formation targeted by the Gasbuggy test. Two of the seven gas wells are horizontal completions within the Pictured Cliffs Formation and are indicated on the attached map as having different bottom hole locations than the well head location at the surface. The number of natural gas production wells that are sampled can vary from year to year, due to varying production schedules for the wells that may be dictated by current natural gas prices.

The U.S. Environmental Protection Agency performed water sampling at water wells, springs, and ponds in the Gasbuggy vicinity from the inception of the Hydrologic Monitoring Program in 1972 through 2007. DOE's Office of Legacy Management performed the hydrologic sampling at these locations in 2007, 2008, and 2009.

Results of the historical hydrologic monitoring at Gasbuggy have consistently shown that groundwater and surface water at the sample locations have not been impacted by radionuclides from the nuclear test. DOE evaluated the Hydrologic Monitoring Program and concluded that some water sample locations were too shallow and not impacted by detonation-related contaminants (DOE 2009a). Therefore, the frequency of hydrologic monitoring was reduced to once every 5 years. The next hydrologic monitoring event is scheduled for 2014.

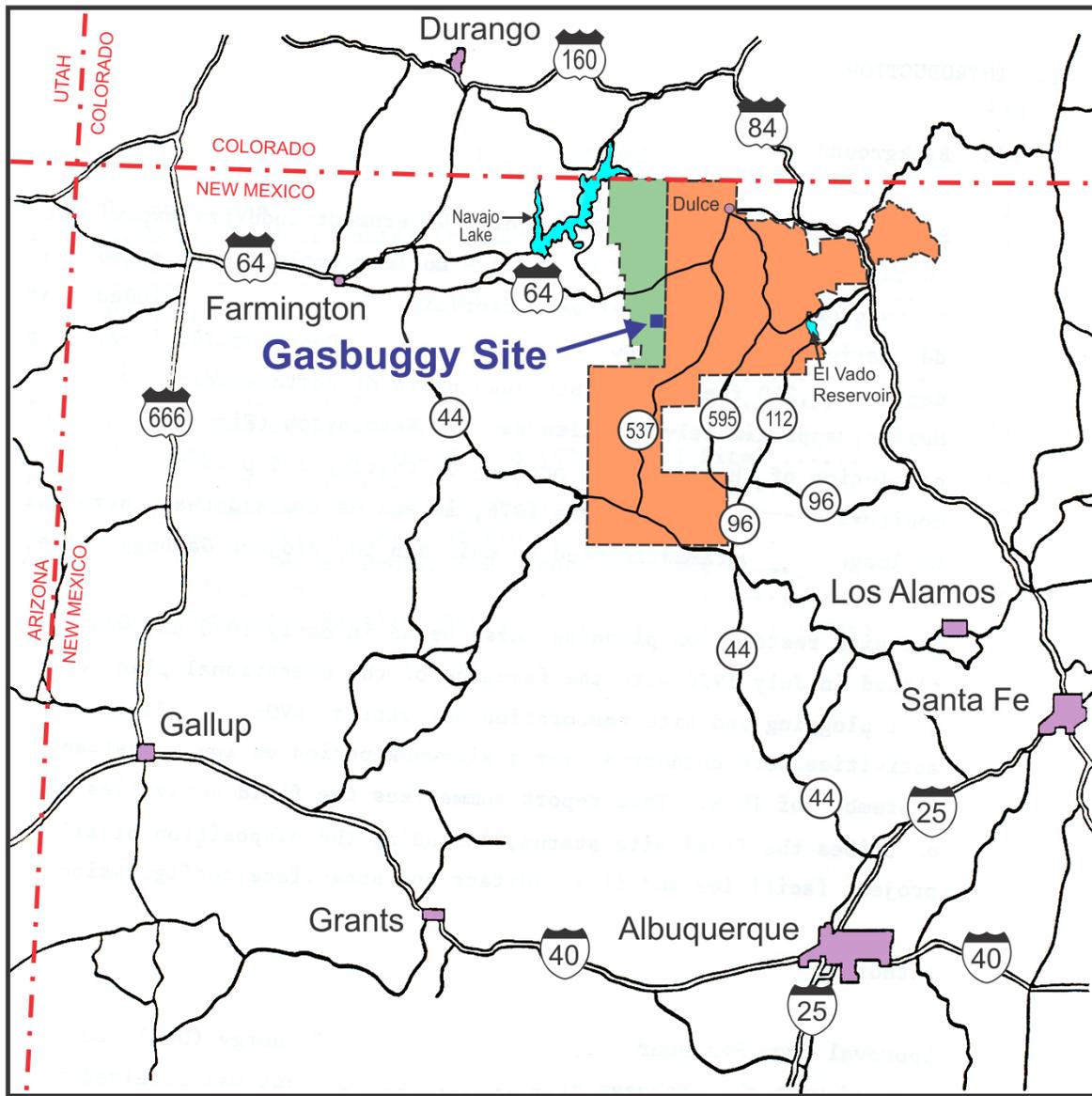


Figure 1. Gasbuggy Site Location Map

Sampling of natural gas and produced water from nearby producing gas wells was conducted for the first time during the 2009 sampling event. Nearby gas wells that are producing gas from the same formation affected by the Gasbuggy test represent a more plausible contaminant migration pathway. Therefore, DOE has been sampling natural gas production wells annually since 2009.

DOE is currently reevaluating the natural gas well sampling frequency. Future routine gas well sampling events may be based on the *volume of gas produced* since the prior sampling event, rather than the amount of time elapsed since the previous sampling event. The rationale considers allowing the gas wells sufficient time between sampling events such that the sampled gas will have travelled to the well from a great enough distance to render a sample that is not a “duplicate” of the prior sample.

DOE has established notification agreements with the U.S. Bureau of Land Management and the U.S. Forest Service, whereby DOE will be notified of new gas well permitting activity in the area. DOE plans to sample new natural gas wells that are drilled in the vicinity of Gasbuggy.

The next routine natural gas sampling event is scheduled for 2014, concurrent with the next hydrologic sampling event. Any modification to the natural gas well sampling frequency would take place after the 2014 sampling event. Initial sampling of new natural gas wells would be based on well-specific considerations not related to the sampling of existing gas wells.

3.0 Sample Analytical Results

Analytical results from the June 18–19, 2013, sampling event are shown in Tables 1 and 2. Tritium, the most mobile detonation-related contaminant and consequently the contaminant of greatest concern to DOE, was not detected in any of the water or natural gas samples.

Low levels of gross beta activity were detected in samples of produced water from two of the natural gas production wells; one of the results was an estimated value.¹ The other well, Schalk 29-4 No. 007, had a gross beta activity level of 664 picocuries per liter (pCi/L). This well also had a gamma spectrometry result of 530 pCi/L from potassium-40. Similar results were obtained from this well during the 2011 and 2012 sampling events (DOE 2011 and 2012). Potassium-40 decays by beta emission along with a gamma ray and is likely the source of the gross beta activity detected in the well. Potassium-40 is a naturally occurring radioisotope that is not a byproduct of a nuclear detonation and, therefore, is not attributable to the Gasbuggy test.

The well identified as Valencia Canyon Unit No. 037, with an estimated value of 23.9 pCi/L for gross beta activity, had similar results during the 2012 sampling event (DOE 2012). Low levels of gross beta activity are common in the natural environment and would not indicate contamination attributable to the Gasbuggy test.

¹ When a reported radionuclide concentration is less than three times the method detection limit, the result is considered an estimated value because of the high degree of uncertainty associated with very low measured concentrations.

Table 1. Gasbuggy Natural Gas Production Well Produced Water Sample Analysis Results

Sample Location (API #)	Collection Date	Tritium (pCi/L)	Gamma Spectrometry (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
Indian A No. 002 (30-039-07525)	06/19/2013	ND	ND	ND	ND
Many Canyons 29-04-26 No. 133 (30-039-29988)	06/19/2013	NA	NA	NA	NA
Many Canyons 29-04-25 No. 123 (30-039-30161)	06/19/2013	NA	NA	NA	NA
Schalk 29-4 No. 007 (30-039-21620)	06/19/2013	ND	530	23.2 ^a	664
Schalk 29-4 No. 014 (30-039-21744)	06/19/2013	NA	NA	NA	NA
Schalk 29-4 No. 017 (30-039-21743)	06/19/2013	ND	ND	ND	ND
Valencia Canyon Unit No. 037 (30-039-21647)	06/18/2013	ND	ND	ND	23.9 ^a

^a Estimated value.

API = American Petroleum Institute

NA = not analyzed

ND = not detected

pCi/L = picocuries per liter

Table 2. Gasbuggy Natural Gas Production Well Gas Sample Analysis Results

Sample Location (API #)	Collection Date	Tritium (pCi/L) ^a	Carbon-14 (pCi/L)
Indian A No. 002 (30-039-07525)	06/19/2013	ND	ND
Many Canyons 29-04-26 No. 133 (30-039-29988)	06/19/2013	ND	ND
Many Canyons 29-04-25 No. 123 (30-039-30161)	06/19/2013	ND	ND
Schalk 29-4 No. 007 (30-039-21620)	06/19/2013	ND	ND
Schalk 29-4 No. 014 (30-039-21744)	06/19/2013	ND	ND
Schalk 29-4 No. 017 (30-039-21743)	06/19/2013	ND	ND
Valencia Canyon Unit No. 037 (30-039-21647)	06/18/2013	ND	ND

^a All concentrations in this table are in picocuries per liter (pCi/L) of methane.

API = American Petroleum Institute

ND = not detected

pCi/L = picocuries per liter

Gas wells Many Canyons 29–04–25 No. 123, Many Canyons 29–04–26 No. 133, and Schalk 29-4 No. 014 did not have any produced water for sample analyses at the time of sampling, which is typical of these wells. Refer to Table 1 for produced water sample analytical results.

No tritium or carbon-14 was detected in the natural gas samples. Although tritium has never been detected, carbon-14 has been detected in low concentrations during past sampling events (DOE 2009b and DOE 2010). Refer to Table 2 for natural gas sample analytical results.

4.0 Conclusions

Results from the sampling of natural gas and produced water from producing wells demonstrate that the gas wells nearest the Gasbuggy site are not currently impacted by detonation-related contaminants. The next natural gas and produced water sampling event will be in 2014, concurrent with the next hydrologic sampling event.

5.0 References

DOE (U.S. Department of Energy), 2009a. *Gasbuggy, New Mexico Long-Term Hydrologic Monitoring Program Evaluation Report*, LMS/GSB/S04019, Office of Legacy Management, Grand Junction, Colorado, June.

DOE (U.S. Department of Energy), 2009b. *Gasbuggy, New Mexico, Hydrologic and Natural Gas Sampling and Analysis Results for 2009*, LMS/GSB/S05869, Office of Legacy Management, Grand Junction, Colorado, November.

DOE (U.S. Department of Energy), 2010. *Gasbuggy, New Mexico, Hydrologic and Natural Gas Sampling and Analysis Results for 2010*, LMS/GSB/S07076, Office of Legacy Management, Grand Junction, Colorado, December.

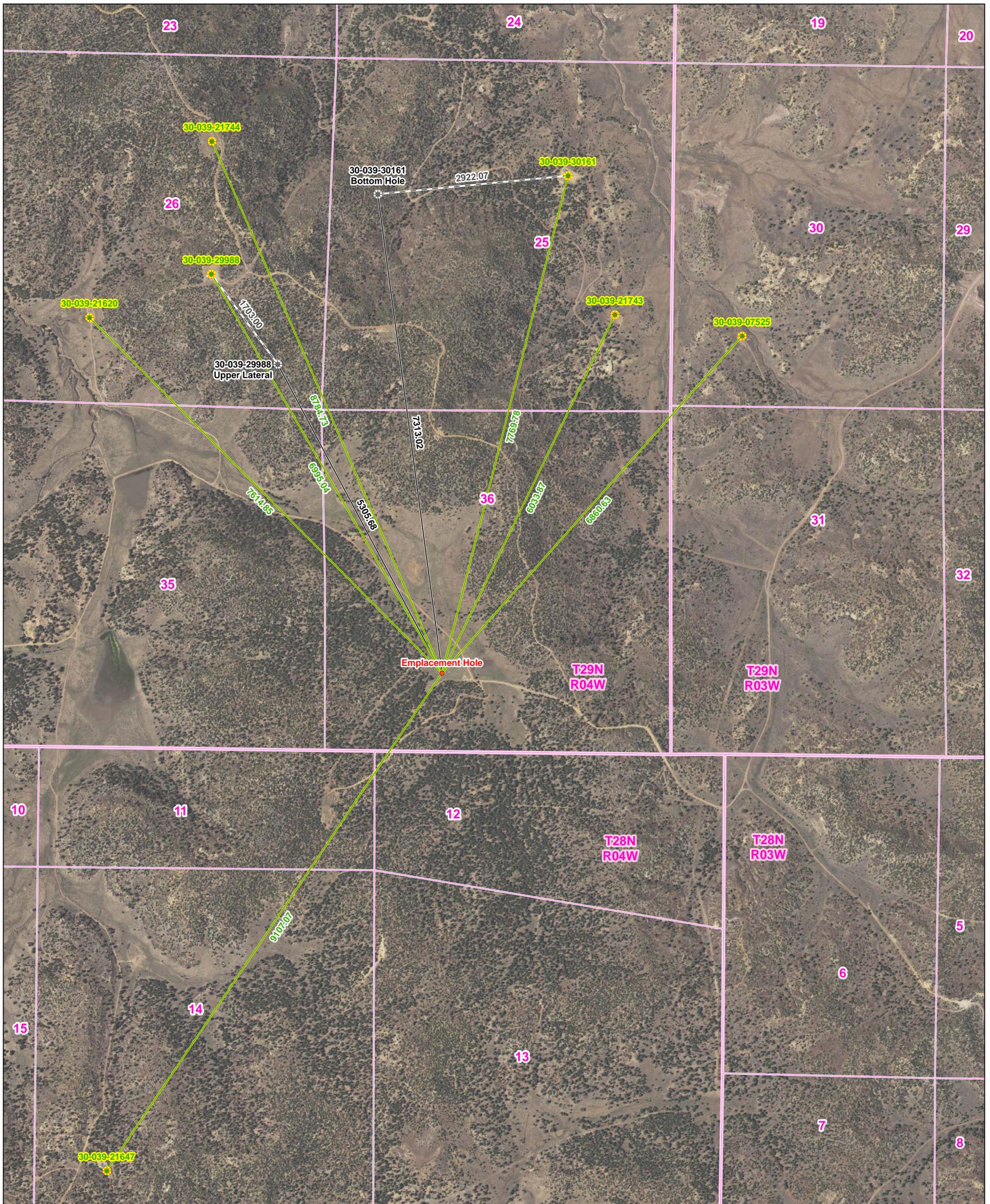
DOE (U.S. Department of Energy), 2011. *Gasbuggy, New Mexico, Natural Gas and Produced Water Sampling and Analysis Results for 2011*, LMS/GSB/S08153, Office of Legacy Management, Grand Junction, Colorado, September.

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Gas Sample Location Map

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LEGEND

- Natural Gas Well
- Natural Gas Well - Bottom Hole
- Emplacement Hole
- Emplacement Hole to Natural Gas Well (Feet)
- Emplacement Hole to Natural Gas Well - Bottom Hole (Feet)
- Natural Gas Well to Bottom Hole (Feet)



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Work Performed by
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Under DOE Contract
No. DE-AM01-07LM00060

Distances of Sampled Natural Gas Wells,
and Bottom Hole Locations From Emplacement Hole
Gasbuggy, NM, Site
2013 Sampling Event

DATE PREPARED:
October 3, 2013

FILENAME:
S1084100