2010 Groundwater Monitoring and Inspection Report Gnome-Coach Site, New Mexico

February 2011

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1.0 Introduction

This report presents the 2010 groundwater monitoring results collected by the U.S. Department of Energy (DOE) Office of Legacy Management (LM) at the Gnome-Coach (Gnome) Site in New Mexico (Figure 1). Groundwater monitoring consisted of collecting hydraulic head data and groundwater samples from the wells on site. Historically, the U.S. Environmental Protection Agency (EPA) had conducted these annual activities under the Long-Term Hydrologic Monitoring Program (LTHMP). LM took over the sampling and data collection activities in 2008 but continues to use the EPA Radiation and Indoor Environments National Laboratory in Las Vegas, Nevada, to analyze the water samples. This report summarizes groundwater monitoring and site investigation activities that were conducted at the site during calendar year 2010.

2.0 Site Location and Background

The Gnome Site consists of 640 acres of federally withdrawn lands approximately 25 miles east of Carlsbad in Eddy County, New Mexico (Figure 1). The site was the location of the first underground nuclear test performed under the Plowshare Program by the U.S. Atomic Energy Commission, predecessor to DOE. The Plowshare Program was a research and development initiative started in 1958 to determine the technical and economic feasibility of peaceful applications of nuclear energy. The underground nuclear test conducted at the Gnome Site was identified as Project Gnome and was performed on December 10, 1961. The test consisted of detonating a nuclear device with an estimated yield of 3 kilotons at a depth of 1,184 feet (ft) below ground surface (bgs) in a bedded salt deposit known as the Salado Formation. Immediately following the detonation, close-in stemming materials failed, and gasses from the cavity vented to the atmosphere through the access shaft and tunnel (Rawson et al. 1964). Post-test drilling operations and preparations for another underground nuclear test, identified as Coach, began shortly after the Project Gnome test. The Coach experiment was initially scheduled for 1963 but was canceled and never executed.

No additional underground nuclear detonations occurred at the Gnome Site; however, in 1963, the U.S. Geological Survey (USGS) conducted a groundwater tracer test using four dissolved radionuclides—tritium, iodine-131, strontium-90, and cesium-137—as tracers. The tracer test was conducted between wells USGS-4 and USGS-8 located west of the blast point, the surface projection of which is surface ground zero (SGZ) (Figure 2). Wells USGS-4 and USGS-8 are completed in the Culebra Dolomite Member of the Rustler Formation that lies above the Salado Formation. The Culebra Dolomite is a fractured carbonate aquifer of Permian age and is considered the most prolific aquifer near the Gnome Site. For this reason, the Culebra aquifer is considered a critical transport pathway, not only for radionuclides used in the tracer test, but also for any detonation-related radionuclides that might be released to groundwater.

Figure 1. Gnome Site Location Map

Figure 2. LTHMP Sampling Locations in 2009

2.1 Summary of Reclamation and Remediation Activities

Surface and subsurface contamination resulted from the underground nuclear testing, post-test drilling, and groundwater tracer test performed at the Gnome Site. The original cleanup associated with the site was conducted between 1968 and 1969. During this phase of the cleanup, radioactive sludge from holding tanks and liquid from evaporation ponds were pumped into the test cavity, contaminated equipment and solid waste were disposed of in the emplacement shaft, uncontaminated buildings and equipment were moved off site, and drill holes were plugged except those retained for the LTHMP (REECO 1981). In 1972, an area reconnaissance revealed that cover material over a waste dump that remained from the post-test drilling operations was eroding and exposing contaminated material. The second major cleanup was conducted from 1977 to 1979 and included excavating contaminated soils from the waste dump and burying them in the emplacement shaft, removing concrete pads, performing general housekeeping activities, and conducting extensive post-cleanup sampling. During these operations, the test cavity and horizontal tunnel were filled to capacity, and remaining contaminated material was transported to the Nevada National Security Sites formerly the Nevada Test Site (REECO 1981).

In 1994, radiological contamination was identified on the surface and in the shallow subsurface (depth of 20 ft bgs) during a survey and sampling event conducted by EPA. The DOE National Nuclear Security Administration (NNSA) Nevada Site Office conducted a corrective action investigation to assess the extent of contamination detected at the site. The field investigation was performed from February through June 2002 and in May 2003. Soil samples were collected and analyzed for radiological and chemical constituents. Analytical results indicated concentrations of total petroleum hydrocarbons diesel-range organics at concentrations that exceeded the State of New Mexico Clean-up Standards. The hydrocarbon contaminated soil was excavated and removed for disposal as part of the corrective action. The Corrective Action Investigation Report (DOE/NNSA 2004) for the Gnome Site summarizes the results of the investigation. After discussions with the State of New Mexico, it was decided that the site would be administered under the Voluntary Remediation Program. A Completion Report, prepared in accordance with the Voluntary Remediation Program, recommended no further corrective actions, no use restrictions for the surface at the Gnome Site, and the eventual goal of clean closure (DOE/NNSA 2005). The State of New Mexico is currently proceeding with a conditional certificate of completion for the surface at the Gnome Site.

Subsurface corrective action activities have been limited at the site and have generally consisted of annual sampling and monitoring of groundwater as part of the LTHMP. The LTHMP began in 1972 and was performed by EPA until 2008. The purpose of the LTHMP was to ensure public safety, inform the public and news media, and document compliance with state and federal requirements (EPA 1972). The initial planning document for the program included the collection of samples from 11 locations, three of which were on site. Since 1972, locations used for long-term sampling have changed; some locations were abandoned or replaced, and new locations have been added. Samples collected from these locations have generally been analyzed for gamma-emitting radionuclides (using high-resolution gamma spectrometry), strontium-90, and tritium (using conventional and electrolytic enrichment methods). Table 1 shows well sample location information, including the distance and direction from SGZ, the formation monitored, and the year sampling began.

Table 1. LTHMP Sample Locations: 1972 to 2009

Sample Location	Distance and Direction from SGZ	Formation/Unit Monitored	First Year of Sampling	Comments
USGS-1	2,250 ft southwest	Culebra Dolomite	1972	Completed with pump and used by ranchers for livestock.
USGS-4	3,180 ft west	Culebra Dolomite	1972	Used in the 1963 tracer test.
USGS-8	3,060 ft west	Culebra Dolomite	1972	Used in the 1963 tracer test.
PHS-6	4.6 miles southeast	Gatuna Formation	1972	Completed with pump and used by ranchers for livestock.
PHS-8	4.3 miles south	Rocks of Triassic age	1972	Completed with pump and used by ranchers for livestock.
PHS-9	3.5 miles southwest	Gatuna Formation	1972	Completed with pump and used by ranchers for livestock.
PHS-10	5.15 miles southwest	Culebra Dolomite	1972	Completed with pump and used by ranchers for livestock.
DD-1	285 ft south	Salado Formation	1981	Reentry well drilled into the detonation cavity. Last sampled in 2005.
LRL-7	2,370 ft south	Salado Formation	1981	Drilled into a shaft constructed for the Coach underground test.
J. Mobley Ranch	3.4 miles north-northwest	Unknown	1993	Well screen interval and completion depth unknown. May monitor Culebra Dolomite.
Carlsbad City Well No. 7	28.7 miles west	Capitan Limestone	1972	Completed with pump. Used as a City supply well.
Loving City Well No. 7	21.7 miles west	Capitan Limestone	2006	Well screen interval and completion depth unknown. Used as a City supply well.
Loving City Well No. 2	13.2 miles west	Capitan Limestone	1972	Well plugged in 2005.
Malaga City Tap Water	12.2 miles west	Piped from Loving	1972	Last sampled in 1976.
Pecos River Pumping Station Well No. 1	15 miles south-southeast	Undifferentiated rocks of Tertiary and Quaternary age	1972	Last sampled in 1992.

Responsibility for the Gnome Site was transferred from the DOE Office of Environmental Management to LM on October 1, 2006. After the transfer, LM evaluated the LTHMP and associated monitoring network. The purpose of the evaluation was to determine the effectiveness of the current monitoring network and determine future monitoring at the site. The evaluation considered feasible pathways for contaminant migration from the detonation zone and tracer test to surrounding receptors. Analytical results from more than 30 years of monitoring indicate that groundwater at sample locations outside the land-withdrawal boundary (Figure 1) were not impacted by nuclear-test-related contamination. For this reason, locations outside the land-withdrawal boundary have been excluded from future sampling, but wells within and near the boundary will continue to be monitored. LM installed pressure transducers in the on-site monitoring wells to obtain hydraulic head data for continued evaluation of the site. Results of the hydraulic head monitoring are provided in Section 4.2.

3.0 Geology and Hydrology

The Gnome Site is in the northwestern part of the Delaware Basin, a deep oval sedimentary basin 75 miles wide and 135 miles long in southeastern New Mexico. The geology and hydrology of this basin are well studied because of oil and gas exploration, mining, and the extensive studies required to locate the Waste Isolation Pilot Plant approximately 8 miles north-northeast of the Gnome Site. The basin deposits dip gently to the east and southeast, though in places the bedding is almost flat. During the late Permian Period, a warm shallow sea in the region provided ideal environments for reef development, which blocked seawater circulation. As the seawater began to evaporate, brines were formed, and crystalline salts precipitated and accumulated on the basin floor. As a result, the Gnome Site area is underlain by several thousand feet of limestone, dolomite, gypsum, halite, anhydrite, and potassium salts (potash). The Salado Formation, in which the Gnome detonation took place, is a 2,500-ft-thick bed of halite that formed during the Permian Period. The Salado Formation is virtually impermeable due to the plastic nature of the salt under pressure.

Overlying the Salado Formation are five thin-bedded members of the Rustler Formation. This formation includes the Culebra Dolomite Member, which was the subject of extensive study during the location and siting phases of the Waste Isolation Pilot Plant. Above the Culebra Dolomite is the Tamarisk Anhydrite Member, which is overlain by the Magenta Dolomite. The uppermost member of the Rustler Formation is the Forty-Niner Member, a mixture of gypsum and anhydrite. The youngest Permian sequences in the Gnome Site area are the thin, red, sedimentary rocks of the Dewey Lake Redbeds. At the Gnome Site, about 200 ft of Permian-age anhydrites, mudstones, and dolomites separate the Culebra Dolomite from younger overlying formations.

The Culebra Dolomite is a widespread, laterally continuous, fractured carbonate aquifer that is approximately 30 ft thick and is encountered approximately 490 ft bgs at the Gnome Site. The groundwater within the Culebra generally moves through fractures and is of poor quality because of high concentrations of dissolved solids (Mercer 1983). The Culebra is the most prolific aquifer near the Gnome Site, and despite the poor water quality it is a source of water for ranchers maintaining livestock throughout the area.

4.0 Groundwater Monitoring and Investigation Results

Groundwater monitoring and site investigation activities conducted in 2010 consisted of geophysical well logging, hydraulic head monitoring, and groundwater sampling. Results obtained from these activities are summarized in the following sections.

4.1 Geophysical Well Logging and Results

COLOG Well Services conducted geophysical well logging on April 7 and 21, 2010, at wells USGS-1, USGS-4, and USGS-8. The well logging included borehole deviation, downhole video, and gamma-ray logging. The data were acquired to assist in the evaluation of these wells for continued monitoring. Table 2 provides the borehole geophysical techniques and approximate footage for the wells.

Table 2. Geophysical Well Logs, Wells USGS-1, USGS-4, and USGS-8

Geophysical Logs	Well USGS-1 (ft)	Well USGS-4 (ft)	Well USGS-8 (ft)
Video Log	Not Logged	0 to 512	0 to 495
Deviation Survey	0 to 500	0 to 512	Not Logged ^a
Gamma Log	Not Logged	0 to 512	0 to 495

^a A deviation log was not obtained because previous data are available and are provided in Appendix A to this report.

COLOG acquired borehole deviation data from wells USGS-1 and USGS-4. A deviation survey was not conducted at well USGS-8 because deviation data were available from when the well was installed in 1963 (Appendix A). Wells USGS-1 and USGS-4 were logged on April 7, 2010. Well USGS-4 was re-logged on April 21, 2010 because data acquired from the logging on April 7 needed to be verified for horizontal direction. The deviation survey of well USGS-1 reached a measured depth of 500 ft bgs, just above the pump. The survey indicates that the well deviates approximately 2.5 degrees from vertical with an offset in plan view of approximately 9 ft northwest of the surface collar and that the measured depth of 500 ft bgs is at a true vertical depth of 499.88 ft bgs. The deviation survey for well USGS-4 reached a measured depth of 502.9 ft bgs. The survey indicates that the well deviates approximately 15 degrees from vertical with an offset in plan view of approximately 60 ft west of the surface collar and that the measured depth of 502.9 ft bgs is at a true vertical depth of 496.46 ft bgs (a 6.36-ft difference at this depth).

Gamma ray logs were acquired from wells USGS-4 and USGS-8 on April 7, 2010. Data obtained from these wells provide geologic information that can be correlated with other wells in the area and new wells as data become available. Elevated gamma ray counts (as high as 30,000 API units) were observed from 460 to 480 ft bgs in well USGS-8 and are attributed to residual cesium-137 from the tracer test conducted by the USGS in 1963. Downhole video logs of wells USGS-4 and USGS-8 indicated that the casing in well USGS-4 was more corroded than the casing in well USGS-8, though the casings in both wells are in generally good condition for their age. The video logs are maintained in the LM project files in Grand Junction.

4.2 Hydraulic Head Monitoring and Results

Hydraulic head is monitored in the on-site wells USGS-1, USGS-4, USGS-8, and LRL-7. Depth to water was measured in wells USGS-1, USGS-4, USGS-8, and LRL-7 in January and April 2010. Monitoring was enhanced in April 2010 with the installation of a flow meter to measure flow rates from water supply well USGS-1 and with the installation of a pressure transducer in well DD-1. Table 3 presents the water level data and groundwater elevations obtained in 2010 with the zone of completion and unit monitored for the wells.

Table 3. Gnome Site Water Levels

Well	Date	DTW (ft) ^a	TOC Elevation (ft) ^b	TSZ Elevation (ft) ^b	BSZ Elevation (ft) ^b	Formation/Unit Monitored	Groundwater Elevation (ft) ^b
USGS-1 ^c	01/26/2010	434.30	3,425.78	2,907.78	2,875.78	Culebra Dolomite	2,991.48
USGS-4	04/07/2010	426.72	3,415.25	2,943.22	2,909.70	Culebra Dolomite	2,993.36
USGS-8	04/06/2010	419.30	3,412.96	2,949.96	2,917.96	Culebra Dolomite	2,993.66
LRL-7	04/06/2010	459.00	3,442.42	2,654.42	2,128.42	Salado Formation	2,983.42
DD-1	04/06/2010	NM	3,398.18	NM	NM	Salado Formation	NM

DTW = Depth to water (all measurements obtained from north top of casing)

TOC = Top of casing elevation in feet above mean sea level

TSZ = Top of screen zone, uncased/open interval, or perforated interval in feet above mean sea level

BSZ = Bottom of screen zone, uncased/open interval, or perforated interval in feet above mean sea level

NM = Not measured

^a Depth to water has not been corrected for true vertical depth.

^b Elevation has been corrected for true vertical depth.

^c Well USGS-1 has a dedicated submersible pump.

Pressure transducer data from on-site wells USGS-1, USGS-4, USGS-8, and LRL-7 are downloaded in January as part of the annual LM sampling event and again in late summer/fall as part of a regional monitoring event conducted by Sandia National Laboratories. Sandia did not download the transducer data from well DD-1 because access to this well is restricted.

Hydrographs of hydraulic head data are shown in Figure 3 and Figure 4. The hydrographs are grouped according to each well's open interval and formation/unit monitored. A shift in data from wells USGS-4 and USGS-8 observed in April 2010 (Figure 3) occurred because the transducers were removed from the wells during well logging and were not returned to their original depth. The hydraulic head in well USGS-1 is affected by the on/off cycling of the dedicated pump that supplies water for ranchers. Hydraulic head data from wells USGS-1, USGS-4, and USGS-8 have been corrected for true vertical depth. Data obtained from well LRL-7 (Figure 4) indicate that water levels did not fully recover from the sampling conducted annually in January. Hydraulic head data from the transducer recently installed in well DD-1 will provide additional information associated with the Salado Formation.

4.3 Groundwater Sampling and Results

Groundwater samples were collected from wells USGS-1, USGS-4, USGS-8, and LRL-7 on January 26 and 27, 2010. Samples were not collected from the off-site locations. Monitoring wells USGS-4, USGS-8, and LRL-7 were sampled using dedicated low-flow submersible bladder pumps. The tubing inlets of the bladder pumps are located in the screened or open interval to allow water to be collected directly from the adjacent geologic formation. This limits the volume of purge water to the volume of water in the pump tubing, and the low flow rates minimize mixing with stagnant water in the well bore. The sample collected from well USGS-1 was collected as a grab sample because the pump was operating at the time of the sampling. Samples were analyzed for gamma-emitting radionuclides (using high-resolution gamma spectrometry), strontium-90, and tritium (using conventional and electrolytic enrichment methods).

Figure 3. Hydrograph Showing Water Elevations in Wells USGS-1, USGS-4, and USGS-8

Figure 4. Hydrograph Showing Water Elevations in Well LRL-7

Analytical results obtained from the 2010 monitoring event indicate that contaminant concentrations in on-site wells USGS-4, USGS-8, and LRL-7 were consistent with previous analytical results. Concentrations in well LRL-7 are the result of contamination from waste disposal during the site cleanup, and concentrations in wells USGS-4 and USGS-8 are the result of radionuclides injected during the tracer test in 1963. Cesium-137 concentrations in samples collected from wells USGS-8 and LRL-7 and tritium concentrations in samples collected from well LRL-7 during the 2008, 2009, and 2010 sampling events were higher than concentrations measured in 2007. The increased concentrations are due to changes in the sampling method that was implemented after the 2007 monitoring event, in which dedicated low-flow bladder pumps were installed. Table 4 lists the analytical results from the wells that were sampled during the January 2010 sampling event.

Table 4. Gnome Site Groundwater Sample Analytical Results

Sample Location	Collection Date	Tritium (pCi/L)	Enriched Tritium (pCi/L)	Cesium-137 (pCi/L)	Strontium-90 (pCi/L)	Formation/Unit Monitored
USGS-1	01/26/2010	<146	7.6	<2.1	<0.89	Culebra Dolomite
USGS-1 (duplicate)	01/26/2010	<146	<3.4	<1.4	<1.9	Culebra Dolomite
USGS-4	01/26/2010	13,200	NA	<1.4	2,540	Culebra Dolomite
USGS-8	01/27/2010	25,500	NA	181	3,320	Culebra Dolomite
LRL-7	01/26/2010	4,350	NA	129	<33	Salado Formation

NA = not analyzed
pCi/L = picocuries per liter

Estimated tritium concentration in a sample collected from well USGS-1 and analyzed by the electrolytic enriched method was 7.6 picocuries per liter (pCi/L). This concentration is below the worldwide tritium distribution in precipitation that resulted from aboveground nuclear tests during the 1950s and early 1960s (Brown 1995). For comparison, the EPA drinking water standard for tritium is 20,000 pCi/L. The remaining analytical results obtained from well USGS-1 indicated no detections above laboratory method detection limits (Table 4).

Charts 1 through 7 in Appendix B show temporal plots of radionuclide concentrations (1972 through 2010) in samples collected at wells LRL-7, USGS-4, and USGS-8. Concentration results are plotted on a semilogarithmic scale. All sample results, including nondetects, are plotted. As indicated in the figures, many results from sampling events before the late 1980s had no reported detection limit. For interpretation purposes, relatively high concentrations (i.e., concentrations significantly higher than detection limits associated with subsequent sampling) should be considered detections.

5.0 Conclusions

The geophysical well logging was successful in obtaining borehole deviation data from wells USGS-1 and USGS-4, gamma ray logs from wells USGS-4 and USGS-8, and downhole video logs from wells USGS-4 and USGS-8. The borehole deviation data allow groundwater elevations to be calculated from true vertical depth corrected depth-to-water measurements. Groundwater elevations can be used to calculate hydraulic gradients and groundwater flow directions at the site. The gamma ray logs will be used for geologic information and to correlate with other wells in the area. Data obtained from the video logs suggest that the casings are in generally good condition for their age. The well-logging data support the use of wells USGS-1, USGS-4, and USGS-8 for long-term monitoring at the site.

Hydraulic head data obtained from well LRL-7 (Figure 4) indicate that water levels did not fully recover from the annual sampling conducted in January. Data from the transducer in well DD-1 will be downloaded as part of the annual sampling event in 2011 and will provide additional information on the Salado Formation. The concentrations of tritium, strontium-90, and cesium-137 in groundwater samples collected in January 2010 from on-site wells are consistent with concentrations from historical monitoring results.

6.0 References

Brown, R.M., 1995. Monthly Tritium in Precipitation at Ottawa, Canada, 1953–1995, Atomic Energy of Canada Limited, <http://mysite.science.uottawa.ca/idclark/courses/Tritium%20and%20groundwater%20age.doc>, accessed February 2010.

DOE/NNSA (U.S. Department of Energy National Nuclear Security Administration), 2004. *Surface Corrective Action Investigation Report for the Gnome-Coach Site, New Mexico*, DOE/NV-926, May.

DOE/NNSA (U.S. Department of Energy National Nuclear Security Administration), 2005. *Voluntary Remediation Program Completion Report Gnome-Coach Site, New Mexico*, Rev. 1, DOE/NV-1077, December.

EPA (U.S. Environmental Protection Agency), 1972. *Environmental Monitoring Report for the Nevada Test Site and Other Test Areas used for Underground Nuclear Detonations*, NERC-LV-539-23, May.

Mercer, J.W., 1983. *Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Los Medanos Area, Southeastern New Mexico*, U.S. Geological Survey Water-Resources Investigations Report 83-4016.

Rawson, D, C. Boudman, and N. Jaffe-Chazan, 1964. *The Environment Created by a Nuclear Explosion in Salt*, Lawrence Radiation Laboratory, University of California, Livermore, California, September.

REECO (Reynolds Electrical & Engineering Company, Inc.), 1981. *Gnome Site Decontamination and Decommissioning Project—Radiation Contamination Clearance Report*, DOE/NV/004410-59, Las Vegas, Nevada, August.

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Appendix A

COLOG Well Logs and Eastman Deviation Data—USGS-8

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Sheet6

Deviation Survey for:

S. M. Stoller Corporation

Field: Gnome-Coach

Date: 4/7/2010

Well: USGS-1

Depth Ref.: GS

Total Depth: 501.90 ft

Probe Type, S/N: Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist.Sum (feet)	NorthSum (feet)	EastSum (feet)
0.0	1.494	337.113	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0	1.159	319.852	0.3	0.01	0.30	0.00	0.00	2.73	0.06	0.05	-0.04
6.0	0.876	293.140	0.3	0.00	0.30	0.00	0.00	5.76	0.12	0.08	-0.08
9.0	0.553	274.508	0.3	0.00	0.30	0.00	0.00	8.78	0.15	0.09	-0.12
12.0	0.534	263.528	0.3	0.00	0.30	0.00	0.00	11.81	0.18	0.09	-0.15
15.0	0.524	288.762	0.3	0.00	0.30	0.00	0.00	14.84	0.20	0.09	-0.18
18.0	0.552	293.358	0.3	0.00	0.30	0.00	0.00	17.87	0.23	0.10	-0.21
21.0	0.634	289.181	0.3	0.00	0.30	0.00	0.00	20.90	0.26	0.11	-0.23
24.0	0.651	254.306	0.3	0.00	0.30	0.00	0.00	23.93	0.29	0.11	-0.26
27.0	0.603	241.392	0.3	0.00	0.30	0.00	0.00	26.96	0.31	0.10	-0.29
30.0	0.589	241.506	0.3	0.00	0.30	0.00	0.00	29.99	0.33	0.09	-0.32
33.0	0.587	247.920	0.3	0.00	0.30	0.00	0.00	32.72	0.36	0.08	-0.35
36.0	0.671	234.050	0.3	0.00	0.30	0.00	0.00	35.75	0.39	0.06	-0.38
39.0	0.781	225.462	0.3	0.00	0.30	0.00	0.00	38.78	0.41	0.04	-0.41
42.0	0.706	231.219	0.3	0.00	0.30	0.00	0.00	41.81	0.44	0.01	-0.43
45.0	0.476	258.092	0.3	0.00	0.30	0.00	0.00	44.84	0.46	0.00	-0.46
48.0	0.487	285.899	0.3	0.00	0.30	0.00	0.00	47.87	0.50	0.00	-0.50
51.0	0.608	282.986	0.3	0.00	0.30	0.00	0.00	50.90	0.53	0.01	-0.53
54.0	0.509	272.076	0.3	0.00	0.30	0.00	0.00	53.93	0.55	0.02	-0.55
57.0	0.708	262.431	0.3	0.00	0.30	0.00	0.00	56.96	0.59	0.02	-0.59
60.0	0.960	252.891	0.3	0.01	0.30	0.00	0.00	59.99	0.63	0.01	-0.63
63.0	0.837	250.791	0.3	0.00	0.30	0.00	0.00	62.71	0.67	-0.01	-0.67
66.0	0.589	278.947	0.3	0.00	0.30	0.00	0.00	65.74	0.71	-0.02	-0.71
69.0	0.565	290.230	0.3	0.00	0.30	0.00	0.00	68.77	0.73	-0.01	-0.73
72.0	0.565	300.649	0.3	0.00	0.30	0.00	0.00	71.80	0.75	0.00	-0.75
75.0	0.720	299.787	0.3	0.00	0.30	0.00	0.00	74.83	0.78	0.02	-0.78
78.0	0.654	261.845	0.3	0.00	0.30	0.00	0.00	77.86	0.81	0.03	-0.81
81.0	0.526	258.926	0.3	0.00	0.30	0.00	0.00	80.89	0.85	0.03	-0.84
84.0	0.518	221.477	0.3	0.00	0.30	0.00	0.00	83.92	0.87	0.01	-0.87
87.0	0.482	264.214	0.3	0.00	0.30	0.00	0.00	86.95	0.89	0.01	-0.89
90.0	0.673	283.053	0.3	0.00	0.30	0.00	0.00	89.98	0.92	0.01	-0.92
93.0	0.506	286.276	0.3	0.00	0.30	0.00	0.00	92.70	0.95	0.02	-0.95
96.0	0.404	240.243	0.3	0.00	0.30	0.00	0.00	95.73	0.97	0.03	-0.97
99.0	0.564	211.830	0.3	0.00	0.30	0.00	0.00	98.76	0.99	0.01	-0.99
102.0	0.630	221.575	0.3	0.00	0.30	0.00	0.00	101.79	1.00	-0.02	-1.00
105.0	0.586	214.123	0.3	0.00	0.30	0.00	0.00	104.82	1.02	-0.04	-1.02
108.0	0.498	258.475	0.3	0.00	0.30	0.00	0.00	107.85	1.05	-0.05	-1.05
111.0	0.462	240.148	0.3	0.00	0.30	0.00	0.00	110.88	1.07	-0.05	-1.07
114.0	0.403	232.040	0.3	0.00	0.30	0.00	0.00	113.91	1.09	-0.07	-1.09
117.0	0.583	253.838	0.3	0.00	0.30	0.00	0.00	116.94	1.11	-0.08	-1.11
120.0	0.665	279.397	0.3	0.00	0.30	0.00	0.00	119.97	1.14	-0.09	-1.14
123.0	0.708	269.537	0.3	0.00	0.30	0.00	0.00	122.70	1.18	-0.08	-1.17
126.0	0.589	274.202	0.3	0.00	0.30	0.00	0.00	125.73	1.21	-0.08	-1.21
129.0	0.703	219.377	0.3	0.00	0.30	0.00	0.00	128.76	1.24	-0.10	-1.24
132.0	0.715	210.606	0.3	0.00	0.30	0.00	0.00	131.79	1.27	-0.13	-1.26
135.0	0.622	225.495	0.3	0.00	0.30	0.00	0.00	134.82	1.29	-0.16	-1.28
138.0	0.638	260.442	0.3	0.00	0.30	0.00	0.00	137.85	1.32	-0.17	-1.31
141.0	0.885	277.793	0.3	0.00	0.30	0.00	0.00	140.88	1.36	-0.17	-1.35
144.0	0.831	268.879	0.3	0.00	0.30	0.00	0.00	143.91	1.40	-0.17	-1.39
147.0	0.694	249.545	0.3	0.00	0.30	0.00	0.00	146.93	1.44	-0.17	-1.43
150.0	0.737	230.095	0.3	0.00	0.30	0.00	0.00	149.96	1.47	-0.19	-1.46
153.0	0.721	232.603	0.0	0.00	0.00	0.00	0.00	152.99	1.50	-0.22	-1.49
156.0	0.634	239.733	0.3	0.00	0.30	0.00	0.00	155.72	1.53	-0.24	-1.51
159.0	0.643	290.353	0.3	0.00	0.30	0.00	0.00	158.75	1.56	-0.24	-1.54
162.0	0.549	290.530	0.3	0.00	0.30	0.00	0.00	161.78	1.58	-0.23	-1.56
165.0	0.446	274.805	0.3	0.00	0.30	0.00	0.00	164.81	1.60	-0.23	-1.58
168.0	0.734	249.315	0.3	0.00	0.30	0.00	0.00	167.84	1.63	-0.23	-1.61

Sheet6

Deviation Survey for: S. M. Stoller Corporation Field: Gnome-Coach Date: 4/7/2010
Well: USGS-1 Depth Ref.: GS Total Depth: 501.90 ft Probe Type, S/N: Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist.Sum (feet)	NorthSum (feet)	EastSum (feet)
171.0	0.960	240.736	0.3	0.01	0.30	0.00	0.00	170.87	1.67	-0.24	-1.65
174.0	1.054	245.486	0.3	0.01	0.30	0.00	-0.01	173.90	1.72	-0.26	-1.70
177.0	0.681	261.002	0.3	0.00	0.30	0.00	0.00	176.93	1.77	-0.28	-1.75
180.0	0.718	294.819	0.3	0.00	0.30	0.00	0.00	179.96	1.80	-0.28	-1.78
183.0	0.720	303.264	0.3	0.00	0.30	0.00	0.00	182.99	1.83	-0.26	-1.82
186.0	0.719	286.312	0.3	0.00	0.30	0.00	0.00	185.71	1.86	-0.25	-1.85
189.0	0.422	234.582	0.3	0.00	0.30	0.00	0.00	188.74	1.89	-0.24	-1.88
192.0	0.388	218.290	0.3	0.00	0.30	0.00	0.00	191.77	1.91	-0.25	-1.89
195.0	0.335	227.845	0.3	0.00	0.30	0.00	0.00	194.80	1.92	-0.26	-1.91
198.0	0.820	277.907	0.3	0.00	0.30	0.00	0.00	197.83	1.95	-0.26	-1.93
201.0	0.989	265.455	0.3	0.01	0.30	0.00	-0.01	200.86	2.00	-0.26	-1.98
204.0	1.003	260.044	0.3	0.01	0.30	0.00	-0.01	203.89	2.05	-0.26	-2.03
207.0	0.919	271.036	0.3	0.00	0.30	0.00	0.00	206.92	2.10	-0.27	-2.08
210.0	0.867	284.867	0.3	0.00	0.30	0.00	0.00	209.95	2.14	-0.26	-2.13
213.0	1.045	294.180	0.3	0.01	0.30	0.00	0.00	212.98	2.19	-0.24	-2.18
216.0	1.000	277.429	0.3	0.01	0.30	0.00	-0.01	215.71	2.24	-0.23	-2.22
219.0	0.615	261.220	0.3	0.00	0.30	0.00	0.00	218.73	2.28	-0.23	-2.27
222.0	0.623	261.089	0.3	0.00	0.30	0.00	0.00	221.76	2.31	-0.23	-2.30
225.0	0.673	266.404	0.3	0.00	0.30	0.00	0.00	224.79	2.35	-0.24	-2.34
228.0	0.793	287.194	0.3	0.00	0.30	0.00	0.00	227.82	2.38	-0.23	-2.37
231.0	0.709	302.369	0.3	0.00	0.30	0.00	0.00	230.85	2.42	-0.22	-2.41
234.0	0.720	301.949	0.3	0.00	0.30	0.00	0.00	233.88	2.45	-0.20	-2.44
237.0	0.806	289.827	0.3	0.00	0.30	0.00	0.00	236.91	2.48	-0.18	-2.48
240.0	1.118	286.723	0.3	0.01	0.30	0.00	-0.01	239.94	2.53	-0.16	-2.52
243.0	1.077	293.581	0.3	0.01	0.30	0.00	-0.01	242.97	2.59	-0.14	-2.58
246.0	0.913	285.449	0.3	0.00	0.30	0.00	0.00	245.70	2.63	-0.13	-2.63
249.0	0.540	259.159	0.3	0.00	0.30	0.00	0.00	248.73	2.67	-0.12	-2.66
252.0	0.593	243.700	0.3	0.00	0.30	0.00	0.00	251.76	2.69	-0.13	-2.69
255.0	0.583	248.396	0.3	0.00	0.30	0.00	0.00	254.79	2.72	-0.15	-2.72
258.0	0.568	279.427	0.3	0.00	0.30	0.00	0.00	257.82	2.75	-0.15	-2.75
261.0	0.590	270.294	0.3	0.00	0.30	0.00	0.00	260.84	2.78	-0.15	-2.78
264.0	0.664	264.518	0.3	0.00	0.30	0.00	0.00	263.87	2.82	-0.15	-2.81
267.0	0.641	288.254	0.3	0.00	0.30	0.00	0.00	266.90	2.85	-0.14	-2.85
270.0	0.712	316.378	0.3	0.00	0.30	0.00	0.00	269.93	2.88	-0.12	-2.88
273.0	0.712	313.986	0.3	0.00	0.30	0.00	0.00	272.96	2.91	-0.09	-2.90
276.0	0.786	306.743	0.3	0.00	0.30	0.00	0.00	275.69	2.93	-0.07	-2.93
279.0	1.091	296.237	0.3	0.01	0.30	0.00	-0.01	278.72	2.97	-0.04	-2.97
282.0	1.304	293.085	0.3	0.01	0.30	0.00	-0.01	281.75	3.03	-0.02	-3.03
285.0	1.276	292.557	0.3	0.01	0.30	0.00	-0.01	284.78	3.09	0.01	-3.09
288.0	1.042	285.255	0.3	0.01	0.30	0.00	-0.01	287.81	3.15	0.04	-3.15
291.0	0.990	276.959	0.3	0.01	0.30	0.00	-0.01	290.84	3.20	0.04	-3.20
294.0	0.931	271.279	0.3	0.00	0.30	0.00	0.00	293.86	3.25	0.05	-3.25
297.0	1.381	269.195	0.3	0.01	0.30	0.00	-0.01	296.89	3.30	0.06	-3.30
300.0	1.491	260.985	0.3	0.01	0.30	0.00	-0.01	299.92	3.37	0.05	-3.37
303.0	1.440	256.358	0.3	0.01	0.30	0.00	-0.01	302.95	3.45	0.03	-3.45
306.0	1.410	256.214	0.0	0.00	0.00	0.00	0.00	305.98	3.52	0.02	-3.52
309.0	1.159	270.196	0.3	0.01	0.30	0.00	-0.01	308.71	3.58	0.01	-3.58
312.0	0.932	271.800	0.3	0.00	0.30	0.00	0.00	311.74	3.64	0.01	-3.64
315.0	1.050	268.919	0.3	0.01	0.30	0.00	-0.01	314.77	3.69	0.02	-3.69
318.0	1.202	288.449	0.3	0.01	0.30	0.00	-0.01	317.79	3.75	0.02	-3.75
321.0	1.382	300.981	0.3	0.01	0.30	0.00	-0.01	320.82	3.81	0.05	-3.81
324.0	1.391	298.643	0.3	0.01	0.30	0.00	-0.01	323.85	3.88	0.08	-3.87
327.0	1.240	288.955	0.3	0.01	0.30	0.00	-0.01	326.88	3.94	0.11	-3.94
330.0	0.990	284.166	0.3	0.01	0.30	0.00	-0.01	329.91	4.00	0.13	-4.00
333.0	0.836	301.648	0.3	0.00	0.30	0.00	0.00	332.94	4.05	0.15	-4.04
336.0	1.137	279.359	0.3	0.01	0.30	0.00	-0.01	335.97	4.09	0.17	-4.08
339.0	1.279	278.419	0.3	0.01	0.30	0.00	-0.01	338.70	4.15	0.18	-4.14

Sheet6

Deviation Survey for: S. M. Stoller Corporation Field: Gnome-Coach Date: 4/7/2010
Well: USGS-1 Depth Ref.: GS Total Depth: 501.90 ft Probe Type, S/N: Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist.Sum (feet)	NorthSum (feet)	EastSum (feet)
342.0	1.286	279.077	0.3	0.01	0.30	0.00	-0.01	341.72	4.22	0.18	-4.21
345.0	1.256	283.438	0.3	0.01	0.30	0.00	-0.01	344.75	4.29	0.20	-4.29
348.0	1.688	281.451	0.3	0.01	0.30	0.00	-0.01	347.78	4.37	0.21	-4.36
351.0	1.925	289.938	0.3	0.01	0.30	0.00	-0.01	350.81	4.46	0.24	-4.45
354.0	1.992	290.963	0.3	0.01	0.30	0.00	-0.01	353.84	4.56	0.28	-4.55
357.0	1.809	285.855	0.3	0.01	0.30	0.00	-0.01	356.87	4.65	0.31	-4.64
360.0	1.452	284.919	0.3	0.01	0.30	0.00	-0.01	359.90	4.73	0.33	-4.72
363.0	1.386	279.350	0.3	0.01	0.30	0.00	-0.01	362.92	4.80	0.34	-4.79
366.0	1.681	281.396	0.3	0.01	0.30	0.00	-0.01	365.95	4.88	0.35	-4.87
369.0	1.617	288.421	0.3	0.01	0.30	0.00	-0.01	368.68	4.95	0.37	-4.94
372.0	1.506	299.153	0.3	0.01	0.30	0.00	-0.01	371.71	5.03	0.41	-5.01
375.0	1.485	310.179	0.3	0.01	0.30	0.01	-0.01	374.74	5.10	0.45	-5.08
378.0	1.454	293.026	0.3	0.01	0.30	0.00	-0.01	377.77	5.16	0.49	-5.14
381.0	1.604	295.639	0.3	0.01	0.30	0.00	-0.01	380.79	5.23	0.53	-5.21
384.0	1.855	289.318	0.3	0.01	0.30	0.00	-0.01	383.82	5.32	0.56	-5.29
387.0	2.088	293.679	0.3	0.01	0.30	0.00	-0.01	386.85	5.41	0.59	-5.38
390.0	2.413	296.880	0.3	0.01	0.30	0.01	-0.01	389.88	5.53	0.64	-5.49
393.0	2.552	298.736	0.3	0.01	0.30	0.01	-0.01	392.90	5.65	0.70	-5.61
396.0	2.378	298.120	0.3	0.01	0.30	0.01	-0.01	395.93	5.78	0.76	-5.73
399.0	1.873	308.555	0.3	0.01	0.30	0.01	-0.01	398.66	5.87	0.82	-5.81
402.0	1.713	302.780	0.3	0.01	0.30	0.00	-0.01	401.68	5.95	0.87	-5.88
405.0	1.539	300.256	0.3	0.01	0.30	0.00	-0.01	404.71	6.03	0.91	-5.96
408.0	1.546	285.325	0.3	0.01	0.30	0.00	-0.01	407.74	6.11	0.95	-6.04
411.0	1.622	267.390	0.3	0.01	0.30	0.00	-0.01	410.77	6.19	0.96	-6.12
414.0	1.888	269.213	0.3	0.01	0.30	0.00	-0.01	413.80	6.28	0.95	-6.21
417.0	1.948	278.477	0.3	0.01	0.30	0.00	-0.01	416.83	6.38	0.95	-6.31
420.0	2.329	296.374	0.3	0.01	0.30	0.01	-0.01	419.85	6.49	0.98	-6.41
423.0	2.698	300.891	0.3	0.01	0.30	0.01	-0.01	422.88	6.61	1.05	-6.52
426.0	2.345	302.716	0.3	0.01	0.30	0.01	-0.01	425.91	6.73	1.13	-6.63
429.0	2.053	288.769	0.3	0.01	0.30	0.00	-0.01	428.63	6.83	1.17	-6.73
432.0	2.052	269.768	0.3	0.01	0.30	0.00	-0.01	431.66	6.94	1.18	-6.84
435.0	1.970	281.600	0.3	0.01	0.30	0.00	-0.01	434.69	7.04	1.19	-6.94
438.0	2.181	292.703	0.3	0.01	0.30	0.00	-0.01	437.72	7.13	1.21	-7.03
441.0	2.578	297.979	0.3	0.01	0.30	0.01	-0.01	440.74	7.25	1.26	-7.14
444.0	2.425	303.054	0.3	0.01	0.30	0.01	-0.01	443.77	7.37	1.33	-7.25
447.0	1.994	309.981	0.3	0.01	0.30	0.01	-0.01	446.80	7.48	1.40	-7.35
450.0	2.079	322.511	0.3	0.01	0.30	0.01	-0.01	449.83	7.56	1.47	-7.42
453.0	1.658	318.641	0.3	0.01	0.30	0.01	-0.01	452.86	7.63	1.54	-7.48
456.0	1.616	314.180	0.3	0.01	0.30	0.01	-0.01	455.88	7.70	1.61	-7.53
459.0	1.682	282.625	0.0	0.00	0.00	0.00	0.00	458.91	7.78	1.66	-7.60
462.0	1.512	288.774	0.3	0.01	0.30	0.00	-0.01	461.64	7.87	1.68	-7.68
465.0	2.036	275.992	0.3	0.01	0.30	0.00	-0.01	464.67	7.97	1.69	-7.79
468.0	2.339	250.199	0.3	0.01	0.30	0.00	-0.01	467.69	8.08	1.68	-7.90
471.0	2.299	245.491	0.3	0.01	0.30	0.00	-0.01	470.72	8.18	1.63	-8.01
474.0	2.310	245.340	0.3	0.01	0.30	-0.01	-0.01	473.75	8.27	1.58	-8.12
477.0	1.982	253.532	0.3	0.01	0.30	0.00	-0.01	476.78	8.37	1.54	-8.23
480.0	1.531	267.769	0.3	0.01	0.30	0.00	-0.01	479.80	8.46	1.52	-8.32
483.0	1.391	287.714	0.3	0.01	0.30	0.00	-0.01	482.83	8.54	1.53	-8.40
486.0	1.428	294.430	0.3	0.01	0.30	0.00	-0.01	485.86	8.61	1.55	-8.47
489.0	1.250	304.902	0.3	0.01	0.30	0.00	-0.01	488.89	8.68	1.57	-8.53
492.0	1.159	299.108	0.3	0.01	0.30	0.00	-0.01	491.92	8.74	1.62	-8.59
495.0	1.150	311.220	0.3	0.01	0.30	0.00	0.00	494.95	8.80	1.67	-8.64
498.0	1.910	258.268	0.3	0.01	0.30	0.00	-0.01	497.98	8.85	1.71	-8.69
501.0	0.930	318.636	0.3	0.00	0.30	0.00	0.00	501.01	8.92	1.74	-8.75
501.9	0.900	323.180	0.3	0.00	0.30	0.00	0.00	501.91	8.93	1.76	-8.76

Sheet6

Deviation Survey for: S. M. Stoller Corporation Field: Gnome-Coach Date: 4/7/2010
 Well: USGS-1 Depth Ref.: GS Total Depth: 501.90 ft Probe Type, S/N: Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist.Sum (feet)	NorthSum (feet)	EastSum (feet)
Totals:											
								True Depth	DistSum	NorthSum	EastSum
								501.91	8.93	1.76	-8.76

Definitions

Bearing = Azimuth Degrees from Magnetic North (Raw Data)

ClosureDistance = Horizontal Feet Between Each Station

ClosureDepth = Vertical Feet Between Each Interval

Northing = North/South Component of Horizontal Distance Between Each Station (Negative = South)
 (Closure Dist.) x cos(Bearing)

Easting = East/West Component of Horizontal Distance Between Each Station (Negative = West)
 (Closure Dist.) x sin(Bearing)

TrueDepth = Vertical Depth from the Surface to This Station

DistanceSum = Horizontal Distance from Wellhead to this Station

NorthSum = North/South Component of Horizontal Distance from the Wellhead to This Station (Negative = South)
 Running Sum of Northing

EastSum = East/West Component of Horizontal Distance from the Wellhead to This Station (Negative = West)
 Running Sum of Easting

Deviation Survey for:
Well: USGS-1

S. M. Stoller Corporation
Depth Ref.: GS

Field: Gnome-Couch
Total Depth: 501.90 ft

Date: 4/7/2010
Probe Type, S/N: Gyro

Orientations are with respect to Magnetic North

Deviation Survey for:
Well: USGS-1

S. M. Steller Corporation
Depth Ref.: GS

Field: Gnome-Coach
Total Depth: 501.90 ft

Date: 4/7/2010
Probe Type, S/N: Gyro

Orientations are with respect to Magnetic North

U.S. Department of Energy
February 2011

Deviation Survey for:
Well: USGS-4

S. M. Stoller Corporation
Depth Ref.: GS

Field: Gnome-Coach
Total Depth: 503.10 ft

Date: 4/21/2010
Probe Type, S/N: Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist.Sum (feet)	NorthSum (feet)	EastSum (feet)
0.0	-999.250	344.069	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0	0.277	172.769	0	0.00	0.30	0.00	0.00	3.03	0.01	0.01	0.00
6.0	0.313	330.944	0	0.00	0.30	0.00	0.00	6.06	0.02	0.02	-0.01
9.0	0.293	307.358	0	0.00	0.30	0.00	0.00	9.08	0.03	0.03	-0.02
12.0	0.275	296.482	0	0.00	0.30	0.00	0.00	12.11	0.05	0.04	-0.03
15.0	0.262	288.529	0	0.00	0.30	0.00	0.00	15.14	0.06	0.04	-0.05
18.0	0.324	283.267	0	0.00	0.30	0.00	0.00	18.17	0.08	0.05	-0.07
21.0	0.339	262.194	0	0.00	0.30	0.00	0.00	21.19	0.09	0.05	-0.08
24.0	0.321	161.768	0	0.00	0.30	0.00	0.00	24.22	0.10	0.04	-0.09
27.0	0.322	170.103	0	0.00	0.30	0.00	0.00	27.25	0.09	0.03	-0.09
30.0	0.295	218.338	0	0.00	0.30	0.00	0.00	30.28	0.10	0.03	-0.10
33.0	0.303	219.358	0	0.00	0.30	0.00	0.00	33.00	0.11	0.01	-0.11
36.0	0.311	208.928	0	0.00	0.30	0.00	0.00	36.03	0.11	0.00	-0.11
39.0	0.266	198.089	0	0.00	0.30	0.00	0.00	39.06	0.12	-0.02	-0.12
42.0	0.285	173.151	0	0.00	0.30	0.00	0.00	42.08	0.13	-0.04	-0.12
45.0	0.428	132.015	0	0.00	0.30	0.00	0.00	45.11	0.13	-0.05	-0.11
48.0	0.418	98.950	0	0.00	0.30	0.00	0.00	48.14	0.12	-0.06	-0.10
51.0	0.240	93.031	0	0.00	0.30	0.00	0.00	51.17	0.10	-0.06	-0.08
54.0	0.253	88.396	0	0.00	0.30	0.00	0.00	54.20	0.09	-0.06	-0.07
57.0	0.386	85.966	0	0.00	0.30	0.00	0.00	57.22	0.08	-0.06	-0.05
60.0	0.329	70.542	0	0.00	0.30	0.00	0.00	60.25	0.07	-0.06	-0.03
63.0	0.354	68.212	0	0.00	0.30	0.00	0.00	62.98	0.06	-0.05	-0.02
66.0	0.415	60.338	0	0.00	0.30	0.00	0.00	66.00	0.05	-0.04	0.00
69.0	0.351	119.527	0	0.00	0.30	0.00	0.00	69.03	0.04	-0.04	0.00
72.0	0.280	192.690	0	0.00	0.30	0.00	0.00	72.06	0.05	-0.05	0.01
75.0	0.299	198.404	0	0.00	0.30	0.00	0.00	75.09	0.06	-0.06	0.01
78.0	0.351	195.798	0	0.00	0.30	0.00	0.00	78.11	0.07	-0.07	0.01
81.0	0.375	345.487	0	0.00	0.30	0.00	0.00	81.14	0.09	-0.09	0.01
84.0	0.302	324.353	0	0.00	0.30	0.00	0.00	84.17	0.07	-0.07	0.00
87.0	0.232	326.457	0	0.00	0.30	0.00	0.00	87.20	0.06	-0.06	-0.01
90.0	0.276	340.680	0	0.00	0.30	0.00	0.00	90.23	0.06	-0.05	-0.02
93.0	0.246	321.613	0	0.00	0.30	0.00	0.00	92.95	0.05	-0.04	-0.02
96.0	0.286	307.194	0	0.00	0.30	0.00	0.00	95.98	0.04	-0.03	-0.03
99.0	0.274	274.181	0	0.00	0.30	0.00	0.00	99.01	0.05	-0.02	-0.05
102.0	0.280	262.660	0	0.00	0.30	0.00	0.00	102.03	0.07	-0.02	-0.06
105.0	0.282	270.494	0	0.00	0.30	0.00	0.00	105.06	0.08	-0.02	-0.08
108.0	0.306	282.500	0	0.00	0.30	0.00	0.00	108.09	0.10	-0.02	-0.10
111.0	0.358	272.444	0	0.00	0.30	0.00	0.00	111.12	0.12	-0.02	-0.11
114.0	0.342	273.551	0	0.00	0.30	0.00	0.00	114.14	0.14	-0.02	-0.13
117.0	0.398	214.262	0	0.00	0.30	0.00	0.00	117.17	0.15	-0.02	-0.15
120.0	0.240	263.156	0	0.00	0.30	0.00	0.00	120.20	0.17	-0.03	-0.17
123.0	0.374	307.983	0	0.00	0.30	0.00	0.00	122.92	0.19	-0.04	-0.18
126.0	0.481	260.847	0	0.00	0.30	0.00	0.00	125.95	0.21	-0.04	-0.20
129.0	0.530	192.505	0	0.00	0.30	0.00	0.00	128.98	0.22	-0.05	-0.22
132.0	0.429	185.622	0	0.00	0.30	0.00	0.00	132.01	0.23	-0.07	-0.22
135.0	0.633	152.478	0	0.00	0.30	0.00	0.00	135.04	0.24	-0.09	-0.22
138.0	0.674	146.115	0	0.00	0.30	0.00	0.00	138.06	0.25	-0.11	-0.22
141.0	0.574	181.103	0	0.00	0.30	0.00	0.00	141.09	0.26	-0.13	-0.23
144.0	0.635	172.891	0	0.00	0.30	0.00	0.00	144.12	0.27	-0.15	-0.22
147.0	0.629	233.297	0	0.00	0.30	0.00	0.00	147.15	0.28	-0.17	-0.22
150.0	0.842	328.096	0	0.00	0.30	0.00	0.00	150.17	0.30	-0.19	-0.23
153.0	1.038	261.636	0	0.00	0.00	0.00	0.00	152.90	0.32	-0.19	-0.26
156.0	0.844	239.013	0	0.00	0.30	0.00	0.00	155.93	0.33	-0.16	-0.28
159.0	0.575	248.084	0	0.00	0.30	0.00	0.00	158.95	0.36	-0.15	-0.33
162.0	1.154	228.271	0	0.01	0.30	0.00	0.00	161.98	0.40	-0.14	-0.38
165.0	1.473	296.170	0	0.01	0.30	0.00	-0.01	165.01	0.44	-0.13	-0.42
168.0	1.645	299.158	0	0.01	0.30	0.00	-0.01	168.03	0.49	-0.11	-0.47
171.0	1.211	317.069	0	0.01	0.30	0.00	0.00	171.06	0.55	-0.06	-0.54

Deviation Survey for:
Well: USGS-4

S. M. Stoller Corporation
Depth Ref.: GS

Field: Gnome-Coach
Total Depth: 503.10 ft

Date: 4/21/2010
Probe Type, S/N: Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist.Sum (feet)	NorthSum (feet)	EastSum (feet)
174.0	1.873	269.984	0	0.01	0.30	0.00	-0.01	174.09	0.61	-0.02	-0.61
177.0	2.380	316.617	0	0.01	0.30	0.01	-0.01	177.11	0.68	0.03	-0.68
180.0	2.087	324.066	0	0.01	0.30	0.01	-0.01	180.14	0.77	0.09	-0.76
183.0	1.826	322.842	0	0.01	0.30	0.01	-0.01	183.16	0.87	0.20	-0.85
186.0	3.281	319.308	0	0.02	0.30	0.01	-0.01	185.88	0.99	0.30	-0.94
189.0	2.870	317.808	0	0.02	0.30	0.01	-0.01	188.91	1.12	0.41	-1.05
192.0	3.986	310.686	0	0.02	0.30	0.01	-0.02	191.93	1.28	0.53	-1.17
195.0	3.853	314.742	0	0.02	0.30	0.01	-0.01	194.95	1.48	0.67	-1.31
198.0	4.399	311.066	0	0.02	0.30	0.02	-0.02	197.97	1.68	0.81	-1.47
201.0	4.689	309.340	0	0.02	0.30	0.02	-0.02	200.99	1.91	0.96	-1.65
204.0	4.315	317.428	0	0.02	0.30	0.02	-0.02	204.01	2.15	1.13	-1.84
207.0	5.194	309.199	0	0.03	0.30	0.02	-0.02	207.02	2.41	1.30	-2.03
210.0	5.490	309.138	0	0.03	0.30	0.02	-0.02	210.04	2.68	1.47	-2.24
213.0	5.502	309.435	0	0.03	0.30	0.02	-0.02	213.05	2.96	1.65	-2.46
216.0	5.604	306.286	0	0.03	0.30	0.02	-0.02	215.76	3.22	1.80	-2.67
219.0	5.479	307.767	0	0.03	0.30	0.02	-0.02	218.78	3.52	1.98	-2.91
222.0	6.877	303.265	0	0.04	0.30	0.02	-0.03	221.79	3.82	2.15	-3.15
225.0	5.918	304.631	0	0.03	0.30	0.02	-0.03	224.80	4.15	2.34	-3.43
228.0	6.265	301.476	0	0.03	0.30	0.02	-0.03	227.81	4.48	2.52	-3.71
231.0	6.451	300.069	0	0.03	0.30	0.02	-0.03	230.82	4.81	2.68	-4.00
234.0	6.381	302.359	0	0.03	0.30	0.02	-0.03	233.82	5.16	2.84	-4.30
237.0	6.841	298.092	0	0.04	0.30	0.02	-0.03	236.83	5.51	3.01	-4.62
240.0	7.150	297.455	0	0.04	0.30	0.02	-0.03	239.83	5.88	3.18	-4.95
243.0	7.022	303.442	0	0.04	0.30	0.02	-0.03	242.84	6.25	3.36	-5.28
246.0	7.917	296.361	0	0.04	0.30	0.02	-0.04	245.54	6.59	3.51	-5.58
249.0	7.793	293.577	0	0.04	0.30	0.02	-0.04	248.54	6.99	3.67	-5.95
252.0	8.556	287.271	0	0.04	0.30	0.01	-0.04	251.54	7.41	3.82	-6.35
255.0	8.961	287.565	0	0.05	0.30	0.01	-0.04	254.53	7.84	3.96	-6.76
258.0	8.482	289.168	0	0.04	0.30	0.01	-0.04	257.52	8.29	4.12	-7.19
261.0	8.651	287.972	0	0.05	0.30	0.01	-0.04	260.52	8.74	4.27	-7.63
264.0	9.803	286.986	0	0.05	0.30	0.01	-0.05	263.50	9.22	4.41	-8.09
267.0	9.616	284.462	0	0.05	0.30	0.01	-0.05	266.49	9.69	4.53	-8.56
270.0	10.347	283.765	0	0.05	0.30	0.01	-0.05	269.47	10.19	4.65	-9.06
273.0	10.368	279.927	0	0.05	0.30	0.01	-0.05	272.45	10.71	4.77	-9.59
276.0	10.374	280.519	0	0.05	0.30	0.01	-0.05	275.13	11.19	4.86	-10.07
279.0	10.923	279.610	0	0.06	0.30	0.01	-0.06	278.10	11.73	4.96	-10.63
282.0	11.489	277.207	0	0.06	0.30	0.01	-0.06	281.07	12.28	5.05	-11.20
285.0	11.530	276.522	0	0.06	0.30	0.01	-0.06	284.04	12.85	5.12	-11.78
288.0	11.786	276.615	0	0.06	0.30	0.01	-0.06	287.01	13.42	5.19	-12.38
291.0	11.338	274.219	0	0.06	0.30	0.00	-0.06	289.97	14.01	5.26	-12.99
294.0	11.868	275.685	0	0.06	0.30	0.01	-0.06	292.94	14.61	5.33	-13.60
297.0	12.401	276.287	0	0.06	0.30	0.01	-0.06	295.90	15.21	5.40	-14.22
300.0	12.223	275.154	0	0.06	0.30	0.01	-0.06	298.85	15.83	5.45	-14.86
303.0	12.675	275.606	0	0.07	0.30	0.01	-0.07	301.81	16.45	5.50	-15.50
306.0	12.350	282.495	0	0.00	0.00	0.00	0.00	304.47	17.09	5.58	-16.15
309.0	12.742	276.553	0	0.07	0.30	0.01	-0.07	307.43	17.66	5.67	-16.73
312.0	12.989	275.211	0	0.07	0.30	0.01	-0.07	310.38	18.31	5.74	-17.39
315.0	13.460	276.463	0	0.07	0.29	0.01	-0.07	313.33	18.96	5.80	-18.05
318.0	13.048	275.159	0	0.07	0.29	0.01	-0.07	316.28	19.63	5.87	-18.74
321.0	13.649	273.225	0	0.07	0.29	0.00	-0.07	319.22	20.31	5.92	-19.43
324.0	13.365	275.386	0	0.07	0.29	0.01	-0.07	322.16	21.01	5.97	-20.14
327.0	13.773	275.585	0	0.07	0.29	0.01	-0.07	325.10	21.70	6.02	-20.85
330.0	14.447	272.139	0	0.07	0.29	0.00	-0.07	328.04	22.42	6.07	-21.58
333.0	14.314	273.689	0	0.07	0.29	0.00	-0.07	330.98	23.13	6.11	-22.31
336.0	14.446	274.643	0	0.07	0.29	0.01	-0.07	333.91	23.86	6.15	-23.05
339.0	14.469	272.347	0	0.07	0.29	0.00	-0.07	336.55	24.52	6.18	-23.72
342.0	14.703	271.547	0	0.08	0.29	0.00	-0.08	339.48	25.25	6.22	-24.47
345.0	14.670	272.401	0	0.08	0.29	0.00	-0.08	342.41	25.99	6.25	-25.23

Deviation Survey for:

S. M. Stoller Corporation

Field: Gnome-Coach

Date: 4/21/2010

Well: USGS-4

Depth Ref.: GS

Total Depth: 503.10 ft

Probe Type, S/N: Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist.Sum (feet)	NorthSum (feet)	EastSum (feet)
348.0	14.832	270.608	0	0.08	0.29	0.00	-0.08	345.34	26.74	6.28	-26.00
351.0	15.050	272.328	0	0.08	0.29	0.00	-0.08	348.26	27.50	6.30	-26.77
354.0	15.053	275.376	0	0.08	0.29	0.01	-0.08	351.19	28.26	6.34	-27.54
357.0	14.794	279.498	0	0.08	0.29	0.01	-0.08	354.11	29.02	6.42	-28.30
360.0	14.799	276.347	0	0.08	0.29	0.01	-0.08	357.04	29.78	6.51	-29.06
363.0	14.149	272.701	0	0.07	0.29	0.00	-0.07	359.97	30.54	6.57	-29.82
366.0	14.406	273.285	0	0.07	0.29	0.00	-0.07	362.90	31.28	6.61	-30.58
369.0	14.633	275.442	0	0.08	0.29	0.01	-0.08	365.54	31.96	6.66	-31.26
372.0	14.409	273.344	0	0.07	0.29	0.00	-0.07	368.47	32.70	6.73	-32.00
375.0	14.040	277.447	0	0.07	0.29	0.01	-0.07	371.40	33.44	6.79	-32.74
378.0	14.568	275.631	0	0.08	0.29	0.01	-0.08	374.34	34.17	6.85	-33.48
381.0	14.164	273.614	0	0.07	0.29	0.00	-0.07	377.27	34.90	6.91	-34.21
384.0	13.389	271.283	0	0.07	0.29	0.00	-0.07	380.21	35.61	6.96	-34.92
387.0	13.657	269.545	0	0.07	0.29	0.00	-0.07	383.16	36.31	7.05	-35.62
390.0	13.689	267.063	0	0.07	0.29	0.00	-0.07	386.10	37.00	7.06	-36.32
393.0	13.766	270.166	0	0.07	0.29	0.00	-0.07	389.05	37.68	7.04	-37.02
396.0	13.474	265.178	0	0.07	0.29	-0.01	-0.07	391.99	38.36	7.02	-37.72
399.0	13.094	264.317	0	0.07	0.29	-0.01	-0.07	394.64	38.97	6.97	-38.35
402.0	13.216	261.137	0	0.07	0.29	-0.01	-0.07	397.59	39.63	6.90	-39.03
405.0	13.340	265.072	0	0.07	0.29	-0.01	-0.07	400.53	40.29	6.82	-39.71
408.0	12.882	262.226	0	0.07	0.30	-0.01	-0.07	403.48	40.95	6.73	-40.39
411.0	13.249	259.016	0	0.07	0.29	-0.01	-0.07	406.43	41.59	6.62	-41.06
414.0	12.883	261.366	0	0.07	0.30	-0.01	-0.07	409.38	42.24	6.51	-41.73
417.0	12.813	259.741	0	0.07	0.30	-0.01	-0.07	412.33	42.88	6.37	-42.40
420.0	12.830	262.486	0	0.07	0.30	-0.01	-0.07	415.28	43.51	6.27	-43.06
423.0	12.924	258.589	0	0.07	0.30	-0.01	-0.07	418.23	44.15	6.16	-43.72
426.0	12.617	260.270	0	0.07	0.30	-0.01	-0.06	421.18	44.79	6.01	-44.38
429.0	12.790	251.839	0	0.07	0.30	-0.02	-0.06	423.84	45.36	5.87	-44.97
432.0	13.237	258.436	0	0.07	0.29	-0.01	-0.07	426.79	45.97	5.70	-45.62
435.0	12.897	253.778	0	0.07	0.30	-0.02	-0.06	429.73	46.62	5.51	-46.29
438.0	12.910	257.927	0	0.07	0.30	-0.01	-0.07	432.68	47.23	5.34	-46.93
441.0	12.712	254.563	0	0.07	0.30	-0.02	-0.06	435.64	47.86	5.19	-47.57
444.0	12.464	256.499	0	0.06	0.30	-0.02	-0.06	438.59	48.47	5.03	-48.21
447.0	12.238	262.295	0	0.06	0.30	-0.01	-0.06	441.55	49.09	4.93	-48.84
450.0	12.105	259.105	0	0.06	0.30	-0.01	-0.06	444.51	49.69	4.82	-49.46
453.0	11.764	257.425	0	0.06	0.30	-0.01	-0.06	447.47	50.29	4.70	-50.07
456.0	11.946	258.022	0	0.06	0.30	-0.01	-0.06	450.44	50.87	4.57	-50.67
459.0	11.797	257.931	0	0.00	0.00	0.00	0.00	453.11	51.45	4.45	-51.26
462.0	11.407	258.089	0	0.06	0.30	-0.01	-0.06	456.07	51.98	4.33	-51.80
465.0	11.536	259.220	0	0.06	0.30	-0.01	-0.06	459.04	52.55	4.20	-52.38
468.0	11.609	257.269	0	0.06	0.30	-0.01	-0.06	462.01	53.12	4.07	-52.96
471.0	11.717	256.936	0	0.06	0.30	-0.01	-0.06	464.97	53.70	3.94	-53.55
474.0	11.618	256.892	0	0.06	0.30	-0.01	-0.06	467.94	54.28	3.81	-54.15
477.0	9.756	260.667	0	0.05	0.30	-0.01	-0.05	470.91	54.82	3.68	-54.69
480.0	11.127	247.684	0	0.06	0.30	-0.02	-0.05	473.89	55.33	3.56	-55.22
483.0	11.718	255.083	0	0.06	0.30	-0.02	-0.06	476.86	55.89	3.42	-55.78
486.0	11.503	256.181	0	0.06	0.30	-0.01	-0.06	479.82	56.47	3.27	-56.38
489.0	11.391	255.701	0	0.06	0.30	-0.01	-0.06	482.79	57.02	3.14	-56.93
492.0	11.654	259.803	0	0.06	0.30	-0.01	-0.06	485.76	57.60	3.03	-57.52
495.0	11.255	255.699	0	0.06	0.30	-0.01	-0.06	488.73	58.17	2.90	-58.10
498.0	10.731	267.519	0	0.06	0.30	0.00	-0.06	491.70	58.73	2.79	-58.66
501.0	11.166	267.771	0	0.06	0.30	0.00	-0.06	494.68	59.27	2.75	-59.20
503.1	-999.250	-999.250	0	0.30	0.05	0.05	0.29	496.51	59.67	2.68	-59.61

Deviation Survey for: S. M. Stoller Corporation   **Field:** Gnome-Coach   **Date:** 4/21/2010
Well: USGS-4   **Depth Ref.:** GS   **Total Depth:** 503.10 ft   **Probe Type, S/N:** Gyro

Depth (feet)	Inclination (degrees)	Bearing (degrees)	ClosureLength (line ft.)	ClosureDist. (horiz. ft.)	ClosureDepth (vertical ft.)	Northing (feet)	Easting (feet)	TrueDepth (feet)	Dist. Sum (feet)	NorthSum (feet)	EastSum (feet)
Definitions Bearing = Azimuth Degrees from Magnetic North (Raw Data) ClosureDistance = Horizontal Feet Between Each Station ClosureDepth = Vertical Feet Between Each Interval Northing = North/South Component of Horizontal Distance Between Each Station (Negative = South) (Closure Dist.) x cos(Bearing) Easting = East/West Component of Horizontal Distance Between Each Station (Negative = West) (Closure Dist.) x sin(Bearing) TrueDepth = Vertical Depth from the Surface to This Station DistanceSum = Horizontal Distance from Wellhead to this Station NorthSum = North/South Component of Horizontal Distance from the Wellhead to This Station (Negative = South) Running Sum of Northing EastSum = East/West Component of Horizontal Distance from the Wellhead to This Station (Negative = West) Running Sum of Easting											

Deviation Survey for:
Well: USGS-4

S. M. Stoller Corporation
Depth Ref.: GS

Field: Gnome-Coach
Total Depth: 503.10 ft

Date: 4/21/2010
Probe Type, S/N: Gyro

Orientations are with respect to Magnetic North

Deviation Survey for:
Well: USGS-4

S. M. Stoller Corporation
Depth Ref.: GS

Field: Gnome-Coach
Total Deptl 503.10 ft

Date: 4/21/2010
Probe Type, S/N: Gyro

Orientations are with respect to Magnetic North

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THIS IS A RECORD OF A SUB-SURFACE SURVEY OF YOUR WELL

It Includes:

1. A title page giving the name of the company, name and number of the well, and the well location.
2. Record of survey sheets giving drift angles, drift direction, true vertical depth, and rectangular coordinates at each point on the survey.
3. A horizontal plan showing each point on the survey in relation to the surface location; also a closure (horizontal displacement and direction) from the surface location to the bottom of the well.
  - (a) A vertical section of surveys will be furnished on request.
  - (b) A notarized affidavit on Multiple Shot surveys will be furnished on request.

NOTE

We retain a copy of your survey report in our files for your convenience; however, should you so desire, all copies of the survey report will be forwarded to you on written request. All surveys are kept in a locked file and are held in strictest confidence. Additional copies of your survey report can be made from the original by any blueprint company.

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REPORT of SUB-SURFACE DIRECTIONAL SURVEY

BURGETT DRILLING COMPANY
COMPANY

JOINT USE WELL
WELL NAME

CARLSBAD, NEW MEXICO
LOCATION

JOB NUMBER
WT 104062

TYPE OF SURVEY
Magnetic Survey

DATE
October 24, 1962

SURVEY BY
Cecil Strasner

OFFICE
Odessa, Texas

FORM D-608 21

RECORD OF SURVEY

JOB NO. WT 104062 DATE October 24, 1962

CHECKED BY _____

STATION	MEASURED DEPTH	DRIFT ANGLE	TRUE VERTICAL DEPTH	COURSE DEVIATION	DRIFT DIRECTION	RECTANGULAR COORDINATES			
						NORTH	SOUTH	EAST	WEST
1	47 00	0° 20'		0 27	S 82 E		0 04	0 27	
2	67 00	0° 25'		0 15	N 06 E	0 11		0 29	
3	86 00	0° 20'		0 11	S 20 E	0 01		0 33	
4	106 00	0° 15'		0 09	S 45 E		0 05	0 39	
5	127 00	0° 20'	127 00	0 04	S 16 E		0 09	0 40	
6	147 00	0° 15'		0 09	S 11 E		0 18	0 42	
7	168 00	0° 20'		0 12	S 18 E		0 29	0 46	
8	188 00	0° 00'		0 00	Vert		0 29	0 46	
9	209 00	0° 00'		0 00	Vert		0 29	0 46	
10	229 00	0° 15'	229 00	0 09	N 71 W		0 26	0 37	
11	250 00	0° 00'		0 00	Vert		0 26	0 37	
12	270 00	0° 15'		0 09	N 40 W		0 19	0 31	
13	291 00	0° 15'		0 09	N 39 W		0 12	0 25	
14	311 00	0° 00'		0 00	Vert		0 12	0 25	
15	332 00	0° 10'	332 00	0 06	N 58 W		0 09	0 20	
16	352 00	0° 10'		0 06	N 20 E		0 03	0 22	
17	373 00	0° 10'		0 06	N 87 E		0 03	0 28	
18	393 00	0° 10'		0 06	N 23 W	0 03		0 26	
19	414 00	0° 00'		0 00	Vert	0 03		0 26	
20	434 00	0° 10'	434 00	0 06	S 60 E		0 00	0 31	
21	455 00	0° 00'		0 00	Vert	0 00		0 31	
22	475 00	0° 15'		0 09	N 84 E	0 00		0 40	
23	496 00	0° 15'		0 09	N 74 E	0 02		0 49	
24	516 00	0° 10'		0 06	N 63 E	0 05		0 54	
25	537 00	0° 30'	537 00	0 18	S 82 E	0 02		0 72	

FORM NO. C-903P

RECORD OF SURVEY

JOB NO. WT 104062 DATE October 24, 1962

CHECKED BY _____

STATION	MEASURED DEPTH	DRIFT ANGLE	TRUE VERTICAL DEPTH	COURSE DEVIATION	DRIFT DIRECTION	RECTANGULAR COORDINATES			
						NORTH	SOUTH	EAST	WEST
26	557 00	0° 10'		0 06	S 07 W		0 04	0 72	
27	578 00	0° 15'		0 09	N 80 E		0 02	0 81	
28	598 00	0° 20'		0 12	S 80 E		0 00	0 93	
29	619 00	0° 10'		0 06	N 14 E	0 06		0 94	
30	639 00	0° 10'	639 00	0 06	N 56 E	0 09		0 99	
31	660 00	0° 30'		0 18	N 74 E	0 14		1 16	
32	680 00	0° 15'		0 09	N 61 E	0 18		1 24	
33	701 00	0° 20'		0 12	N 11 E	0 30		1 26	
34	721 00	0° 15'	721 00	0 09	N 56 E	0 35		1 33	
Closure:						1.38' N	75° 15' E		

FORM NO. C-303P

Appendix B

Well Concentration Plots

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Chart 1. Tritium Concentrations at Wells USGS-4, USGS-8, and LRL-7

Chart 2. Cesium-137 Concentrations at Well USGS-4

Chart 3. Strontium-90 Concentrations at Well USGS-4

Chart 4. Cesium-137 Concentrations at Well USGS-8

Chart 5. Strontium-90 Concentration at Well USGS-8

Chart 6. Cesium-137 Concentration at Well LRL-7

Chart 7. Strontium-90 Concentrations at Well LRL-7

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