Presentation on the requirement to replace the defective monitoring well R-41 – one of the many defective wells in the current monitoring well network at the Los Alamos National Laboratory 63-acre waste disposal facility known as Area G/MDA G

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Dual-screen monitoring Well R-41 Requires Replacement. Reliable monitoring wells along the eastern and northern side of Area G/MDA G are a fundamental requirement for accurate knowledge of groundwater contamination from the wastes buried in the disposal facility. The required network of monitoring wells does not exist at the present time. Well R-41 is at an important location at the northeastern corner of Area G/MDA G but the mistakes made on the installation of the well make it unusable for any purpose. The location of well R-41 is displayed on Figure 2.

The first disposal operations at MDA G beginning in 1957 was dumping of chemical and radioactive wastes in unlined trenches dug in the northeastern region of MDA G. The trenches were open for long periods with runin of large amounts of surface water.

Monitoring well R-41 was installed in February 2009. Well R-41 requires replacement because the two screens were misplaced at depths of 928.0 – 937.7 ft bgs [the upper screen is dry] and 971.5 – 992.1 ft bgs. The deeper screen is installed in an isolated zone of very silty sediments that are not hydraulically connected to the regional aquifer according to the following statement in the pumping test performed in well R-41. From page C-16 in the LANL well R-41 Completion Report:

> Each of two episodes of extended pumping (the 24-h test and purge development) resulted in minor permanent dewatering of the saturated zone. This suggested that the aquifer screened in R-41 may be laterally limited and not well hydraulically connected to the deeper regional aquifer

The regional aquifer water table elevation measured in well R-22 (the closest well to the location of well R-41) predicted that the elevation of the water table at well R-41 would be at a depth of approximately 895 feet below ground surface (ft bgs).

A very serious mistake is that there was a regular flow of groundwater beginning at a depth of 856 ft bgs. The highest flow of groundwater was reported at a depth of 895 ft bgs where the water table of the regional aquifer was predicted to be present. The drilling should have stopped at 895 ft bgs to allow the water level to stabilize and to collect a complete suite of water samples for analysis but this was not done. However, groundwater samples were collected for a limited analytical suite at the borehole depths of 856 ft bgs, 870 ft bgs, 895 ft

bgs, and then approximately every 20 ft to the depth of 1,022 ft bgs. The borehole for well R-41 was drilled to a total depth of 1,024 ft bgs.

The water quality data below in Table 1 is summarized from the water quality data presented in Table 4.2-1 in Appendix B in the LANL Well R-41 Completion Report. Table 4.2-1 is titled *"Summary of Groundwater Screening Samples Collected during Drilling, Well Development, and Aquifer Testing of Well R-41."*

Table 1. Water quality data for groundwater samples collected from the borehole for LANL monitoring well R-41. Source: Table **B-1.3-1** in Appendix B in the LANL Well R-41Completion Report.

Note: The water quality data (WQD) collected during drilling the borehole for well R-41 and during the pumping test after well development are compared to the WQD in Racer for the most recent water sample collected from the well.

	[1]water samples collected from R-41 borehole during drilling - parts per billion (ug/L)								[2]Well R-41 Pumping test	[3]Well R-41 RACER WQD ug/L
	[4]856 5804	870 5790	895 5766	922 5738	962 5698	982 5678	1,002 5658	1,022 5638	[5]973	[6]10-25-11
TDS	239000	327000	261000	281000	235000	249000	244000	232000	221000	150000
Fe	816	1220	493	245	<10U	<10U	205	66	17	<100U
Mn	102	188	37	75	180	244	304	230	34	<10U
Cl	10950	10260	8220	9390	10740	12530	9680	10950	4740	3010
F	1640	1250	780	970	880	1040	830	950	540	346
Na	36020	33710	22730	24990	20090	24000	21610	23570	18240	12700
K	5950	6500	4210	4830	4060	5840	6150	5720	1780	1860
Al	1689	4829	1816	1,139	31	16	372	164	5	<200U
Ba	53	163	72	55	37	40	54	45	26	25.5
Cr	6	3	3	1	1	4	2	3	2	<10U
Cu	33	20	1	2	<1U	<1U	<1U	4	2	<10U
Hg	0.4	0.44	0.27	0.2	0.24	0.29	0.27	0.31	<0.05U	<0.2U
Mo	<1U	<1U	138	<1U	<1U	<1U	108	161	3	3.42
Pb	0.7	2.5	1.7	0.6	<0.2U	<0.2U	0.6	0.2	<0.2U	<2U
Rb	7	10	6	6	4	5	5	5	2	NA
Ti	105	311	119	57	3	<2U	26	10	<2U	NA
Zn	3	11	5	1	<1U	<1U	7	3	7	<10U

For groundwater samples collected from borehole during drilling the Red color denotes highest concentration per analyte.

1 – water quality data from LANL laboratory for filtered water samples discharged from the borehole during drilling.

2 – water quality data for filtered water samples collected from screen 2 in well R-41 after well development during final pump test. Screen 2 is installed from 965.3 to 975 ft below ground surface.

3 – water quality data in RACER data base (now known as Intellus) for filtered water samples collected from LANL well R-41 screen 2.

4 – the depth and elevation for water samples collected from the borehole during drilling ranging from 856 to 1,022 ft below ground surface.

5 – the depth of the intake for the temporary pumping system during the pumping test in screen 2.

6 – the date water sample was collected from the pumping system installed in well R-41.

Al – aluminum, Ba – barium, Cl – chloride, Cr – chromium, Cu – copper, F – fluoride, Fe – iron, Hg – mercury, K – potassium, Mn – manganese, Mo – molybdenum, Na – sodium, Pb – lead, Rb – rubidium, Ti – titanium, Zn – zinc, TDS – total dissolved solids

The evidence of groundwater contamination in the perched zone and in the regional aquifer is provided by the comparison of the markedly higher concentrations measured in the groundwater samples collected during drilling the borehole to the groundwater sample collected from screen 2 on 10-25-11 as follows:

1) the high concentration of total dissolved solids;

2) the high dissolved concentrations of the mobile analytes sodium, potassium, chloride and fluoride;

3) the high dissolved concentrations of iron and manganese;

4) the high dissolved concentrations of many trace metal analytes including aluminum, barium, chromium, copper, mercury, lead, titanium and zinc relative to the concentrations measured in the installed well.

- **The groundwater samples collected during drilling the borehole for well R-41 are irrefutable proof that a contaminated perched zone is present at a depth of approximately 850 to 870 ft bgs.**
- **The groundwater sample collected at 895 ft bgs during drilling the borehole for well R-41 is irrefutable proof that the water table of the regional aquifer is at a depth of approximately 895 ft bgs.**
- **Very importantly, the analyses of the groundwater samples collected at 895 ft bgs and at depths of 922 and 962 ft bgs are irrefutable proof that the wastes buried in Area G/MDA G have contaminated the regional aquifer below the 63-acre waste dump.**
- **There is an immediate need to install two new monitoring wells close to the location of defective monitoring well R-41.**

- A new well is required to fully characterize the groundwater contamination in the perched zone that is present at a depth of approximately 850 to 870 ft bgs.

- A new well is necessary at a depth of approximately 895 to 905 ft bgs to determine the elevation of the water table of the regional aquifer and to fully characterize the groundwater contamination present in the upper part of the regional aquifer.