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JUN 20 2018

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Federal Facility Agreement Section
Division of Site Assessment, Remediation and Revitalization
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2600 Bull Street
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Mr. Jon Richards
Acting Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Richards:

SUBJECT: Biennial Effectiveness Monitoring Report (Sampling Summary) for the Monitored Natural Attenuation at the L-Area Southern Groundwater Operable Unit, 2016 through 2017, SEMS Number: 77

Reference: *Addendum to the Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN)(U), CERCLIS Number 77* (SRNS-RP-2012-00857, Revision 1, May 2013)

In accordance with the terms of the Federal Facility Agreement, the U. S. Department of Energy (DOE) is submitting the groundwater effectiveness monitoring report (EMR) (sampling summary) for your review. Per the referenced addendum, after 2012, sampling results will be presented in four (4) year EMRs, with a two (2) year data summary in letter format (sampling summary) in-between the four (4) year EMRs. This is the second abbreviated EMR (sampling summary) to be submitted since the addendum to the effectiveness monitoring plan was implemented. This letter is transmitting the 2016 through 2017 sampling summary, *Biennial Effectiveness Monitoring Report (Sampling Summary) for the Monitored Natural Attenuation at the L-Area Southern Groundwater Operable Unit, 2016 through 2017.*

Please review the information and provide any comments that you may have within one hundred twenty (120) days of receipt. The effort and time that the South Carolina Department of Health and Environmental Control and the U. S. Environmental Protection Agency have given on the subject operable unit are greatly appreciated.

JUN 2 0 2018

Ms. Susan Fulmer
Mr. Jon Richards

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Biennial Effectiveness Monitoring Report (Sampling Summary) for the Monitored Natural Attenuation at the L-Area Southern Groundwater Operable Unit 2016 through 2017

Introduction

Sampling optimizations that were developed and approved in the *Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the L-Area Southern Groundwater (LASG) Operable Unit (OU) (U)* (SRNS-RP-2012-00169, Revision 1, December 2012) started in the fourth quarter (4Q) of 2012. Key source zone (KSZ) monitoring wells, plume wells that exceed volatile organic constituent (VOC) MCLs, and surface water stations are sampled annually. All Land Use Control (LUC) boundary wells and plume wells not exceeding VOC maximum contaminant levels (MCLs), are sampled biennially instead of annually. Also, full EMR reports are produced every 4th year with a supplemental data summary in letter format submitted every 2 years in-between the 4-year EMRs. These sampling optimizations were additionally documented in the *Addendum to the Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN) (U)* (SRNS-RP-2012-00857, Revision 1, May 2013). This sampling summary letter is the second submitted since the optimizations were implemented and covers data collected during 2016 through 2017.

This sampling summary also reports data collected for L-Area Oil and Chemical Basin (LAOCB) and the L-Area Reactor Seepage Basin (LRSB) performance monitoring that is collected every 5 years. During the *Fourth Five-Year Remedy Review Report for the Savannah River Site* (SRNS-RP-2012-00011, Revision 1.1, November 2013), it was identified that performance monitoring of these two units should be performed with the LASG OU sampling. Sampling for these units was added to the LASG Effectiveness Monitoring Plan Addendum (SRNS-RP-2012-00857, Revision 1, May 2013). Sampling for these two units was conducted in third quarter (3Q) of 2016.

LASG Tritium

Although some wells only require biennial sampling, all monitoring wells and surface water stations were sampled annually during 2016 and 2017. Results are listed in Table 1 and the 4Q 2017 tritium results and plume are displayed on Figure 1. Figure 1 also includes the previous plume coverage from 2009 for comparison purposes. All KSZ monitoring well concentrations were below well specific KSZ concentration limits as well as the MCL (20 pCi/mL) during both 2016 and 2017. All LUC boundary well results were below the MCL. Tritium exceeded MCLs at four groundwater monitoring wells during the 2016 and 2017 sampling events. The highest concentration of tritium in groundwater was at well LSW 25DL with a concentration of 643 pCi/mL in 2016. Concentrations decreased to 593 pCi/mL in 2017. Overall, all monitoring wells display decreasing concentration trends.

L-Lake surface water tritium concentrations are consistent with previous year's results. Surface water station SC20, located upgradient where Steel Creek enters L-Lake, exceeded the 20 pCi/mL MCL during 2016 with a concentration of 21.7 pCi/mL. During 2017, concentrations at SC20 dropped to 8.64 pCi/mL. Surface water stations located downgradient of the groundwater plumes remain below MCLs. One surface water station, SC23, was not sampled during 2016 due to safety concerns with physically accessing the location. The safety issue was resolved and sampling occurred at surface water station SC23 in 2017. Surface water station SC27,

located to the south just below the L-Lake dam, continues to demonstrate steadily decreasing tritium concentrations with a result of 3.24 pCi/mL in 2017, which is below the MCL. These results indicate that the LASG OU remedial action is performing as expected.

LASG Tetrachloroethylene and Trichloroethylene

Although some wells only require biennial sampling, all monitoring wells and surface water stations in the southeast and southwest plumes, and well LSW029DL were sampled annually during 2016 and 2017 for tetrachloroethylene (PCE) and trichloroethylene (TCE). Results are listed in Table 1 and the 4Q 2017 PCE results and plume are displayed on Figure 2. Figure 2 also includes the previous plume coverage from 2009 for comparison purposes.

PCE exceeded the 5 µg/L MCL at four wells during the 2016 and 2017 sampling events. The highest concentration in groundwater was at well LSW 25DL with a concentration of 56.2 µg/L in 2016. In 2017 the concentration decreased to 46.9 µg/L. Concentrations at well LSW026DL to the west of LSW 25DL have been decreasing for the past three years. Concentrations further west at LSW029DL continue to be non-detect for any VOC.

TCE is less prevalent at the LASG OU than PCE. TCE concentrations are less than half the concentration of PCE. TCE only exceeded the MCL of 5 µg/L in one well, LAC 8DL, in 2016 with a concentration of 6.62 µg/L. In 2017 the concentration at LAC 8DL was 1.57 µg/L. All KSZ monitoring well concentrations were below well specific KSZ concentration limits as well as MCLs during both 2016 and 2017. All boundary well results were non-detect for both PCE and TCE.

L-Lake surface water PCE and TCE concentrations are consistent with previous year's results as all stations were non-detect during 2016 and 2017. In the future, if PCE concentrations at well LSW026DL become higher than concentrations at LSW 25DL and LSW030DL, an additional surface water sample location in L-Lake will be collected at the powerline road crossing located south of station LSW026DL. Currently, concentrations at LSW 25DL continue to be greater and concentrations at LSW026DL have been decreasing; therefore no additional surface water samples will be collected. These results indicate that the LASG OU remedial action is performing as expected.

LAOCB Performance Monitoring

Performance monitoring of the LAOCB remedial action for potential contaminant migration constituents (carbon-14, colbalt-60, gross-alpha, non-volatile beta, strontium-90, and tritium) was conducted during 3Q 2016 at two (2) wells, LCO 2DL and LCO 6DL (Figure 3), per the *Addendum to the Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN)(U)* (SRNS-RP-2012-00857, Revision 1, May 2013). Monitoring of these constituents once every five (5) years verifies that the in-situ stabilization and capping of the LAOCB is preventing contaminant migration to groundwater. Results are provided in Table 2. Carbon-14 and Cobalt-60 are now compared to U.S. Environmental Protection Agency MCLs, not tap water Regional Screening Levels. All analytes were below detection or MCLs. Uranium isotopes were not analyzed since the gross-alpha trigger limit of 15 pCi/L was not exceeded. These results indicate that the LAOCB remedial action is performing as expected. To align

with the schedule for submittal of the LAOCB Five-Year Remedy Review Report, future sampling will occur during the years 2020, 2025, etc.

LRSB Performance Monitoring

Performance monitoring of the LRSB remedial action for potential contaminant migration constituent strontium-90 was conducted during 3Q 2016 at well LSB 4 (Figure 3) per the *Addendum to the Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN)(U)* (SRNS-RP-2012-00857, Revision 1, May 2013). Monitoring of strontium-90 once every five (5) years verifies the in-situ stabilization and soil cover of the LRSB is preventing contaminant migration to groundwater. Results are provided in Table 2. Strontium-90 was not detected in the groundwater at LSB 4; therefore, the remedial action is performing as expected. To align with the schedule for submittal of the LRSB Five-Year Remedy Review Report, future sampling will occur during the years 2020, 2025, etc.

Future Sampling and Reporting

No changes are proposed for the sampling and analysis for LASG OU; therefore, it will continue per the *Addendum to the Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN)(U)* (SRNS-RP-2012-00857, Revision 1, May 2013). The reduced sampling (KSZ wells, wells exceeding VOC MCLs, and surface water stations) will occur in 2018. All wells and surface water stations will be sampled in 2019. The five-year sampling for the LAOCB and LRSB performance monitoring will next be conducted in 2020. A full EMR report for the LASG OU will be submitted in 2020.

Table 1: LASG MNA Monitoring Results (2016 through 2017)

L-Area Southern Groundwater MNA Monitoring Results, 2016 and 2017						Radionuclides		VOC			
				SAMPLE COLLECTION DATE	Constituent	TRITIUM	*Well Specific KSZCL for Tritium*	PCE	*Well Specific KSZCL for PCE*	TCE	*Well Specific KSZCL for TCE*
				day-month-year	Unit	pCi/L	pCi/L	ug/L	ug/L	ug/L	ug/L
Station	**Plume Area**	**Well Use**	**Aquifer Zone**		**MCL**	20		5		5	
LAC 8DL	Southeast	KSZ	UAZ_UTRAU	07-Dec-2016		5.91	102.75	15.3	90	6.62	31.5
LAC 8DL	Southeast	KSZ	UAZ_UTRAU	16-Oct-2017		5.22	102.75	7.08	90	1.57	31.5
LAW 2C	Southwest		UAZ_UTRAU	07-Dec-2016		3.71		<EQL (1)		<EQL (1)	
LAW 2C	Southwest		UAZ_UTRAU	16-Oct-2017		4.48		<EQL (1)		<EQL (1)	
LDB 3	Southwest	KSZ	UAZ_UTRAU	08-Dec-2016		[0.854]	282	<EQL (1)	NA	<EQL (1)	NA
LDB 3	Southwest	KSZ	UAZ_UTRAU	11-Oct-2017		4	282	<EQL (1)	NA	<EQL (1)	NA
LSB 4	Southeast	KSZ	UAZ_UTRAU	07-Dec-2016		[0.9]	137.7	<EQL (1)	NA	<EQL (1)	NA
LSB 4	Southeast	KSZ	UAZ_UTRAU	17-Oct-2017		[0.722]	137.7	<EQL (1)	NA	<EQL (1)	NA
LSP 8DU	Southwest		UAZ_UTRAU	07-Dec-2016		<EQL (0.901)		1.11		<EQL (1)	
LSP 8DU	Southwest		UAZ_UTRAU	16-Oct-2017		<EQL (1.05)		<EQL (1)		<EQL (1)	
LSW 2DL	Southeast		UAZ_UTRAU	05-Dec-2016		17.7		[0.86]		<EQL (1)	
LSW 2DL	Southeast		UAZ_UTRAU	16-Oct-2017		19.4		[0.97]		<EQL (1)	
LSW 8C	Western		LAZ_UTRAU	05-Dec-2016		16.5		NS		NS	
LSW 8C	Western		LAZ_UTRAU	18-Oct-2017		16.4		NS		NS	
LSW 8C	Western		LAZ_UTRAU	18-Oct-2017		15.9	Lab Duplicate				
LSW 8DL	Western		UAZ_UTRAU	05-Dec-2016		12.2		NS		NS	
LSW 8DL	Western		UAZ_UTRAU	17-Oct-2017		8.15		NS		NS	
LSW 9C	Western		LAZ_UTRAU	05-Dec-2016		18.1		NS		NS	
LSW 9C	Western		LAZ_UTRAU	31-Oct-2017		13.7		NS		NS	
LSW 9DL	Western		UAZ_UTRAU	05-Dec-2016		50.4		NS		NS	
LSW 9DL	Western		UAZ_UTRAU	16-Oct-2017		46.9		NS		NS	

	KSZCL = 'Key Source Zone Concentration Limit' which is equivalent to 150% of maximum value observed for KSZ monitoring wells between 2005 and 2007 monitoring period.
[##]	EPA Functional Guideline Code of 'J' was applied to the result, indicating an estimated quantity.
<EQL(##)	Constituent was below detection. The sample-specific Estimated Quantitation Limit is in parentheses.
	Result exceeds the KSZCL for KSZ wells, or exceeds the MCL for surface water locations
	Result is between the MCL and the KSZCL for KSZ wells, and exceeds the MCL for all other wells.
	Result is less than the applicable limit and without EPA Functional Guidline qualifiers.
Blue Text	Not a required sample analysis.

Table 1: LASG MNA Monitoring Results (2016 through 2017) *(continued)*

L-Area Southern Groundwater MNA Monitoring Results, 2016 and 2017						Radionuclides		VOC			
				SAMPLE COLLECTION DATE	Constituent	TRITIUM	*Well Specific KSZCL for Tritium*	PCE	*Well Specific KSZCL for PCE*	TCE	*Well Specific KSZCL for TCE*
				day-month-year	Unit	pCi/L	pCi/L	ug/L	ug/L	ug/L	ug/L
Station	**Plume Area**	**Well Use**	**Aquifer Zone**		**MCL**	20		5		5	
LSW 12C	Western	LUC Bndry	LAZ_UTRAU	05-Dec-2016		[0.617]		NS		NS	
LSW 12C	Western	LUC Bndry	LAZ_UTRAU	16-Oct-2017		1.39		NS		NS	
LSW 12DL	Western	LUC Bndry	UAZ_UTRAU	05-Dec-2016		<EQL (1.16)		NS		NS	
LSW 12DL	Western	LUC Bndry	UAZ_UTRAU	16-Oct-2017		<EQL (1.01)		NS		NS	
LSW 12DL	Western		UAZ_UTRAU	16-Oct-2017		<EQL (0.994)	Lab Duplicate				
LSW 14C	Western		LAZ_UTRAU	02-Dec-2016		8.26		NS		NS	
LSW 14C	Western		LAZ_UTRAU	31-Oct-2017		8.23		NS		NS	
LSW 14DL	Western		UAZ_UTRAU	02-Dec-2016		3.91		NS		NS	
LSW 14DL	Western		UAZ_UTRAU	02-Dec-2016		3.96	Lab Duplicate				
LSW 14DL	Western		UAZ_UTRAU	31-Oct-2017		4.29		NS		NS	
LSW 24A	Southwest		GAU	07-Dec-2016		1.18		<EQL (1)		<EQL (1)	
LSW 24A	Southwest		GAU	16-Oct-2017		[0.744]		<EQL (1)		<EQL (1)	
LSW 25DL	Southwest		UAZ_UTRAU	12-Dec-2016		643		56.2		[0.36]	
LSW 25DL	Southwest		UAZ_UTRAU	17-Oct-2017		593		48.4		[0.38]	
LSW002AR	Southeast		GAU	05-Dec-2016		<EQL (1.17)		<EQL (1)		<EQL (1)	
LSW002AR	Southeast		GAU	16-Oct-2017		<EQL (0.963)		<EQL (1)		<EQL (1)	
LSW014A	Western		GAU	02-Dec-2016		<EQL (1.14)		NS		NS	
LSW014A	Western		GAU	31-Oct-2017		<EQL (0.984)		NS		NS	
LSW026DL	Southwest		UAZ_UTRAU	07-Dec-2016		3.06		5.06		<EQL (1)	
LSW026DL	Southwest		UAZ_UTRAU	16-Oct-2017		2.85		4.38		<EQL (1)	
LSW027A	Western	LUC Bndry	GAU	02-Dec-2016		<EQL (1.15)		NS		NS	
LSW027A	Western	LUC Bndry	GAU	12-Oct-2017		<EQL (0.903)		NS		NS	

	KSZCL = 'Key Source Zone Concentration Limit' which is equivalent to 150% of maximum value observed for KSZ monitoring wells between 2005 and 2007 monitoring period.
[##]	EPA Functional Guideline Code of 'J' was applied to the result, indicating an estimated quantity.
<EQL(##)	Constituent was below detection. The sample-specific Estimated Quantitation Limit is in parentheses.
	Result exceeds the KSZCL for KSZ wells, or exceeds the MCL for surface water locations
	Result is between the MCL and the KSZCL for KSZ wells, and exceeds the MCL for all other wells.
	Result is less than the applicable limit and without EPA Functional Guidline qualifiers.
Blue Text	Not a required sample analysis.

Table 1: LASG MNA Monitoring Results (2016 through 2017) ***(continued/end)***

L-Area Southern Groundwater MNA Monitoring Results, 2016 and 2017						Radionuclides		VOC			
				SAMPLE COLLECTION DATE	Constituent	TRITIUM	*Well Specific KSZCL for Tritium*	PCE	*Well Specific KSZCL for PCE*	TCE	*Well Specific KSZCL for TCE*
				day-month-year	Unit	pCi/L	pCi/L	ug/L	ug/L	ug/L	ug/L
Station	**Plume Area**	**Well Use**	**Aquifer Zone**		**MCL**	20		5		5	
LSW027C	Western	LUC Bndry	LAZ_UTRAU	02-Dec-2016		<EQL (1.16)		NS		NS	
LSW027C	Western	LUC Bndry	LAZ_UTRAU	12-Oct-2017		<EQL (0.918)		NS		NS	
LSW028C	Western		LAZ_UTRAU	02-Dec-2016		5.35		NS		NS	
LSW028C	Western		LAZ_UTRAU	16-Oct-2017		5		NS		NS	
LSW029DL	Western		UAZ_UTRAU	07-Dec-2016		4.82		<EQL (1)		<EQL (1)	
LSW029DL	Western		UAZ_UTRAU	16-Oct-2017		5.58		<EQL (1)		<EQL (1)	
LSW030DL	Southwest		UAZ_UTRAU	07-Dec-2016		33.2		9.84		2.7	
LSW030DL	Southwest		UAZ_UTRAU	16-Oct-2017		31.9		8.68		3.68	
LSW031DL	Southeast		UAZ_UTRAU	07-Dec-2016		343		<EQL (1)		<EQL (1)	
LSW031DL	Southeast		UAZ_UTRAU	17-Oct-2017		324		1.05		<EQL (1)	
LSW032DL	Southeast	LUC Bndry	UAZ_UTRAU	07-Dec-2016		[0.675]		<EQL (1)		<EQL (1)	
LSW032DL	Southeast	LUC Bndry	UAZ_UTRAU	17-Oct-2017		<EQL (1.02)		<EQL (1)		<EQL (1)	
SC20	Surface Water		UAZ_UTRAU	07-Dec-2016		21.7		<EQL (1)		<EQL (1)	
SC20	Surface Water		UAZ_UTRAU	18-Oct-2017		8.64		<EQL (1)		<EQL (1)	
SC23	Surface Water		UAZ_UTRAU	07-Dec-2016		NS		NS		NS	
SC23	Surface Water		UAZ_UTRAU	02-Nov-2017		2.36		<EQL (1)		<EQL (1)	
SC24	Surface Water		UAZ_UTRAU	07-Dec-2016		[0.753]		<EQL (1)		<EQL (1)	
SC24	Surface Water		UAZ_UTRAU	02-Nov-2017		3.95		<EQL (1)		<EQL (1)	
SC25	Surface Water		UAZ_UTRAU	07-Dec-2016		1.87		<EQL (1)		<EQL (1)	
SC25	Surface Water		UAZ_UTRAU	31-Oct-2017		3.43		<EQL (1)		<EQL (1)	
SC27	Surface Water		UAZ_UTRAU	07-Dec-2016		3.79		<EQL (1)		<EQL (1)	
SC27	Surface Water		UAZ_UTRAU	18-Oct-2017		3.24		<EQL (1)		<EQL (1)	

	KSZCL = 'Key Source Zone Concentration Limit' which is equivalent to 150% of maximum value observed for KSZ monitoring wells between 2005 and 2007 monitoring period.
[##]	EPA Functional Guideline Code of 'J' was applied to the result, indicating an estimated quantity.
<EQL(##)	Constituent was below detection. The sample-specific Estimated Quantitation Limit is in parentheses.
	Result exceeds the KSZCL for KSZ wells, or exceeds the MCL for surface water locations
	Result is between the MCL and the KSZCL for KSZ wells, and exceeds the MCL for all other wells.
	Result is less than the applicable limit and without EPA Functional Guidline qualifiers.
Blue Text	Not a required sample analysis.

Table 2: LAOCB and LRSB Performance Monitoring Results (2016)

LAOCB Results

	CARBON-14 (pCi/L)	COBALT-60 (pCi/L)	GROSS ALPHA (pCi/L)	NONVOLATILE BETA (pCi/L)	STRONTIUM-90 (pCi/L)	TRITIUM (pCi/mL)
MCL	2,000	100	15	50	8	20
LCO 2DL (08/24/2016)	-3.14 U	-4.09 U	0.502 U	4.84 J	0.961 U	0.285 U
LCO 6DL (8/25/2016)	352	1.94 U	2.81 J	1.9 U	1.69 U	1.5
LCO 2DL Lab Dup	-2.46 U	NA	NA	NA	NA	NA

LRSB Results - 08/24/2016

LSB 4	NA	NA	NA	NA	-1.12 U	NA
LSB 4 Lab Dup	NA	NA	NA	NA	-0.4 U	NA

U - Non Detect
J - Estimated Value
Detection without a qualifier
Exceeds MCL/PRG

NA = not analyzed

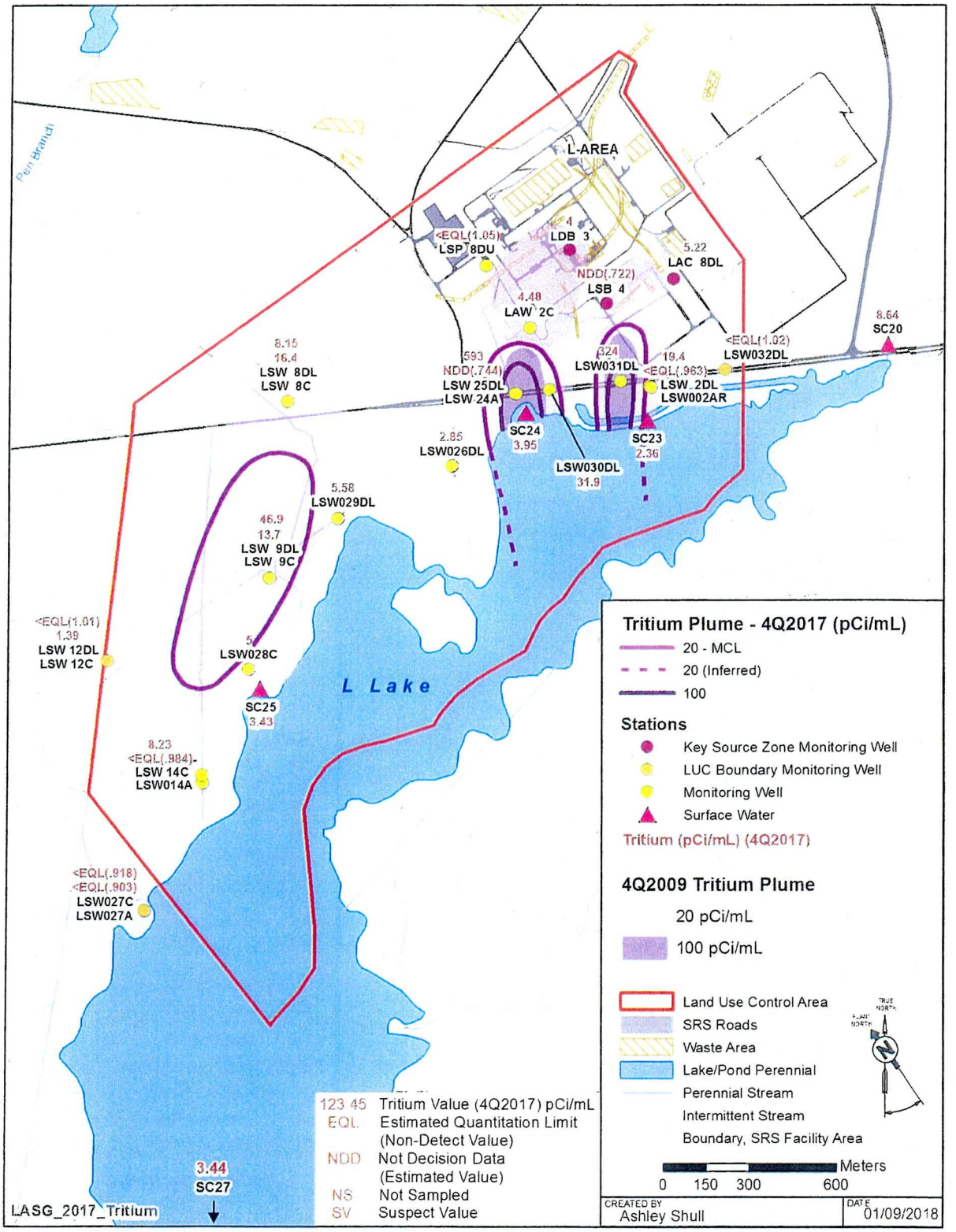

Figure 1: 4Q2017 Tritium Concentrations and Plume at LASG OU

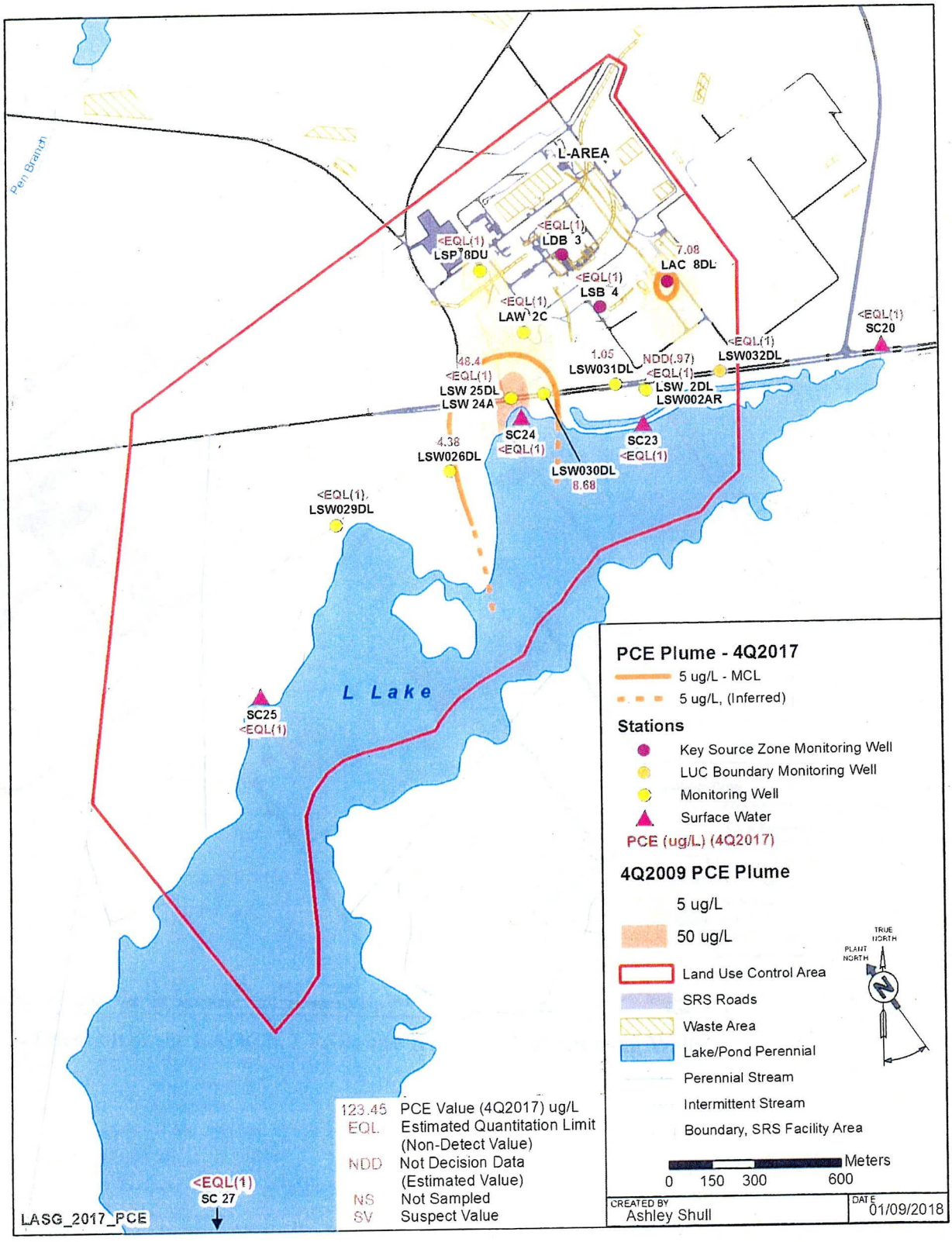

Figure 2: 4Q2017 PCE Concentrations and Plume at LASG OU

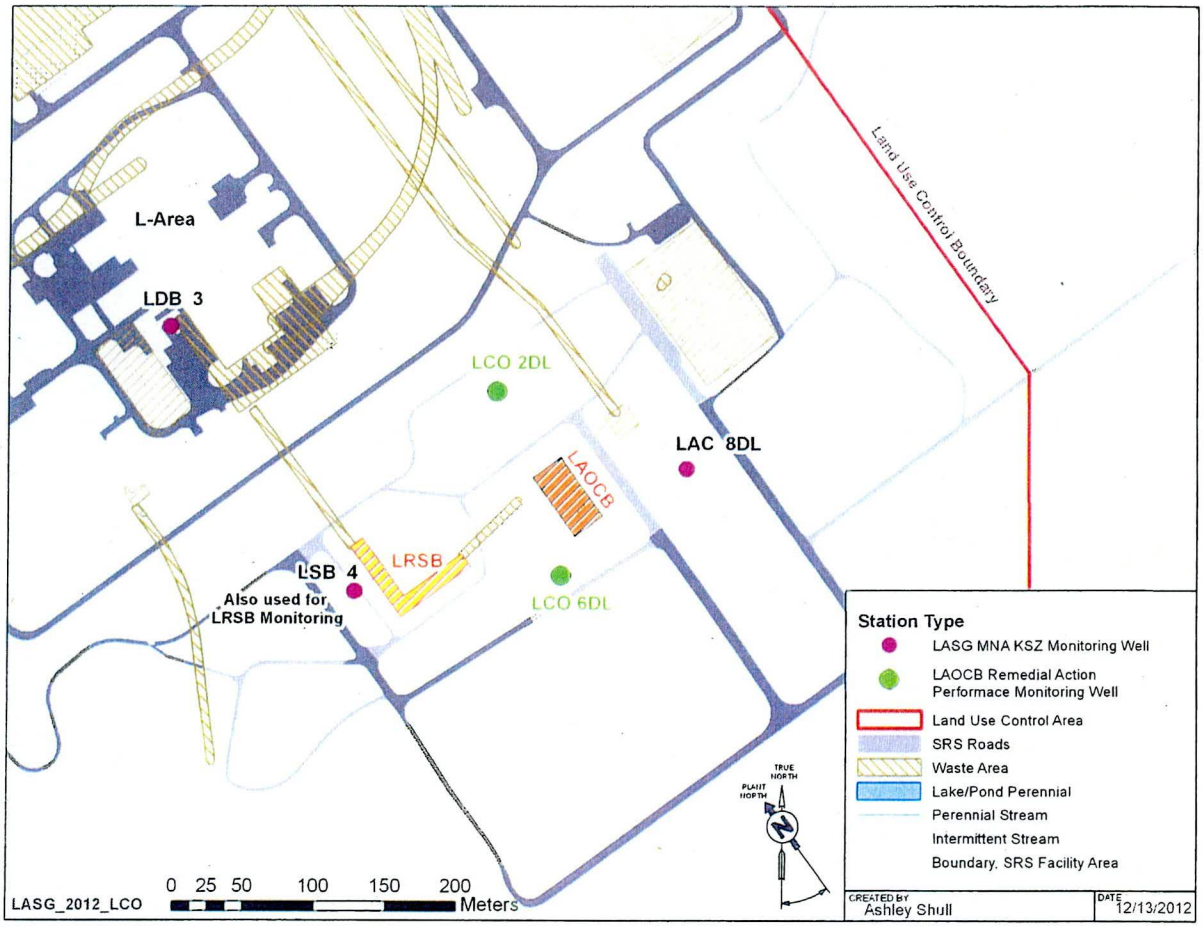

Figure 3: Location of the LAOCB, LRSB, and Associated Monitoring Wells

Questions from you or your staff may be directed to me at (803) 952-8365, or DOE Program Manager, Mr. Philip Prater, at (803) 952-9333.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-18-156

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