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Author(s): Fresquez, Philip R.

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Author(s): Philip R. Fresquez, ENV-ES

PREFACE

This is a working document. As such, new (regional background) data are added as they become available. The purpose of this revision is to include more data pertaining to radionuclides, metals, and polychlorinated biphenyls in whole-body field mice collected from a second arroyo near Espanola, NM. Data from background runoff channels are needed to aid with comparisons of data collected from water channels at Los Alamos National Laboratory.

THE CONCENTRATIONS OF RADIONUCLIDES, HEAVY METALS, AND POLYCHLORINATED BIPHENYLS IN FIELD MICE COLLECTED FROM REGIONAL BACKGROUND AREAS: REVISION 3

P.R. Fresquez

ABSTRACT

Field mice are effective indicators of contaminant presence. This paper reports the concentrations of various radionuclides, heavy metals, polychlorinated biphenyls, high explosives, perchlorate, and dioxin/furans in field mice (mostly deer mice) collected from regional background areas in northern New Mexico. These data, represented as the regional statistical reference level (the mean plus three standard deviations = 99% confidence level), are used to compare with data from field mice collected from areas potentially impacted by Laboratory operations, as per the Environmental Surveillance Program at Los Alamos National Laboratory.

INTRODUCTION

U.S. Department of Energy Orders 436.1 (DOE 2011a) and 458.1 (DOE 2011b) mandate the monitoring of potential contaminants in biota (plants and animals not normally ingested by humans) for the protection of ecosystems. As part of the Environmental Surveillance Program at Los Alamos National Laboratory (LANL), monitoring of biota, mostly in the form of facility-specific or site-specific studies, began in the 1970s, while site wide native vegetation monitoring started in 1994. Presently, in addition to native vegetation, we also monitor amphibians, reptiles, birds, bees, and small mammals like field mice for potential contaminants (Fresquez et al. 2009).

Field mice are effective indicators of contaminant presence because of their feeding (e.g., omnivore) and activity (e.g., burrowing) habits (Arthur et al. 1987, Talmage and Walton 1991), and at LANL they are used as the biota (radionuclide) dose (McNaughton 2006) and (chemical) uptake (Fresquez et al. 2013, Fresquez 2014) models for terrestrial mammals because

they have the smallest home range (0.089 to 1.5 acres) (Wood et al 2010). The three objectives of the biota monitoring program are as follows:

1. Determine chemical concentrations in biota from on-site (LANL property) and perimeter areas and compare these results with those from regional (background) areas, screening levels, and standards.
2. Determine concentration trends over time.
3. Estimate potential dose and risk to biota.

In order to determine the amount of potential contamination in field mice resulting from Laboratory operations, if any, the samples must first be compared with the concentrations of chemicals commonly detected in samples not impacted by LANL (DOE 1991). Regional background samples are collected away from the influence of the Laboratory, and the amounts of chemicals (radionuclides, metals, perchlorate, high explosives, dioxin/furans, and polychlorinated biphenyls [PCBs]) in these samples are a result of worldwide fallout and natural sources/processes. In the case of PCBs and dioxin/furans, they can also enter the regional environment from various (unnatural) sources including waste landfills, waste incineration, urban runoff, sewage sludge, and illegal disposal. High explosives should generally not be detected in regional background samples.

These data, represented as the regional statistical reference level (RSRL) (the upper limit background concentration based on the mean plus three standard deviations = 99% confidence level), are summarized in Tables 1 through 6 and Figure 1 for future reference.

Detailed descriptions of trapping and analysis methods are available in Biggs et al. (1995) and Bennett et al. (1996). In general, the radionuclides (tritium [^{3}H], cesium-137 [^{137}Cs], strontium-90 [^{90}Sr], plutonium-238 [^{238}Pu], plutonium-239,240 [^{239,240}Pu], americium-241 [^{241}Am], uranium-234 [^{234}U], uranium-235 [^{235}U], and uranium-238 [^{238}U]) and target analyte list (TAL) elements (aluminum [Al], barium [Ba], beryllium [Be], calcium [Ca], chromium [Cr], cobalt [Co], copper [Cu], iron [Fe], magnesium [Mg], manganese [Mn], nickel [Ni], potassium [K], sodium [Na], vanadium [V], zinc [Zn], antimony [Sb], arsenic [As], cadmium [Cd], lead [Pb], selenium [Se], silver [Ag], thallium [Tl], and mercury [Hg]) were analyzed by ALS Analytical, Inc. Analysis of PCB congeners in (unwashed) whole-body mouse samples collected in 2007-2008 and 2011-2015 were analyzed by Vista Analytical, Inc., and Cape Fear Analytical, respectively, using

U.S. Environmental Protection Agency (EPA) Method 1668A—high-resolution gas chromatography and high-resolution mass spectrometry. A congener is a specific PCB compound with a certain number of chlorine atoms in certain positions; theoretically, there are 209 possible congeners based on the possible number and position of chlorine atoms. For summary and reporting purposes, PCB congeners were grouped together into 10 homologs; a homolog is a group of congeners with the same number of chlorine atoms, which allows visual comparison of similarities or differences between samples or groups of samples. The designations for the 10 homologs range from monochlorobiphenyl (monoCB) to decachlorobiphenyl (decaCB). Homologs and total PCBs are reported on a pg/g (parts per trillion) wet weight basis. The analyses of high explosives and perchlorate in whole-body mouse samples were conducted by General Engineering Laboratories, Inc., and the analysis of dioxin and furan congeners was conducted by Cape Fear Analytical using EPA Method 8290.

Table 1. Radionuclide Concentrations in (Whole Body) Composite Field Mice Samples Collected from Regional Background Locations.[ab]

Location/Year[c]	^{3}H pCi/mL	^{137}Cs	^{90}Sr	^{238}Pu	$^{239,240}Pu$	^{241}Am pCi/g ash	^{234}U	^{235}U	^{238}U
Frijoles Mesa/2002	0.31	0.26	1.7	0.0024	-0.0012	0.0041	0.063	0.0032	0.072
Frijoles Mesa/2002	0.13	-0.56	2.0	0.0014	-0.00080	0.0015	0.053	0.0061	0.051
Frijoles Mesa/2002	0.020	-0.28	1.8	0.0029	-0.00080	0.0015	0.049	0.0064	0.043
Frijoles Mesa/2003	0.00	-0.29	1.3	0.0010	0.0030	0.0014	0.043	0.0039	0.056
Frijoles Mesa/2003	0.19	-0.13	1.5	0.00080	0.0032	0.00080	0.055	0.0038	0.054
Frijoles Mesa/2003	-0.15	0.42	1.7	0.00070	0.0023	0.00070	0.036	0.0014	0.046
San Ildefonso/2009	0.33	0.00	0.32	-0.00080	0.00090	0.0036	0.089	0.0031	0.080
Espanola/2013	0.17	-0.55	0.23	0.00300	0.0042	-0.0030	0.026	0.0027	0.025
Espanola/2015	-0.20	-0.26	0.14	0.00040	0.0032	0.0044	0.020	-0.0009	0.026
Mean	0.09	-0.15	1.19	0.0013	0.0016	0.0017	0.0482	0.0033	0.050
Std Dev	0.19	0.33	0.75	0.0013	0.0021	0.0023	0.0208	0.0022	0.018
RSRL	**0.65**	**0.85**	**3.4**	**0.0051**	**0.0078**	**0.0084**	**0.11**	**0.010**	**0.11**

[a]A sample consists of a composite of 5 to 10 whole body animals each.

[b]Analysis conducted by ALS.

[c]Frijoles Mesa (shrubland) is located on the south side of LANL near Bandelier National Monument; San Ildefonso (grassland) is located about 7 miles east of LANL on the east side of the Rio Grande; Espanola (arroyos) is located approximately 20 miles north of LANL.

Table 2. TAL Concentrations (mg/kg wet) in (Whole Body) Field Mice Collected from Regional Background Locations.[ab]

Location/Year[c]	Al [d]	Ba	Be	Ca	Cr	Co	Cu	Fe	Mg	Mn	Ni
Guaje Canyon/2007	48	3.2	0.0048	11000	0.30	0.041	2.2	77	350	3.7	
Guaje Canyon/2007	47	4.2	0.0057	10000	0.32	0.061	2.9	96	470	6.7	
Guaje Canyon/2007	29	1.8	0.0039	10000	0.28	0.036	2.4	84	300	2.0	
Medanales/2008	16	3.1	0.0081	9500	0.26	0.034	3.2	77	310	2.5	0.072
Medanales/2008	16	1.9	0.0140	9100	0.25	0.037	2.7	110	340	1.9	0.045
San Ildefonso/2009	4.8	1.8	0.0031	11000	0.21	0.054	5.7	51	370	2.5	0.063
San Ildefonso/2009	4.7	1.6	0.0031	10000	0.20	0.043	3.4	48	450	1.7	0.085
San Ildefonso/2009	4.4	1.9	0.0053	11000	0.19	0.032	2.8	72	330	1.9	0.052
San Ildefonso/2009	7.5	2.1	0.0053	8600	0.17	0.031	3	95	380	3.0	0.044
Espanola/2013	42	4.7	0.0220		0.31	0.006	2.6	120		2.3	0.078
Espanola/2013	54	5.3	0.0230		0.30	0.018	2.4	110		2.8	0.120
Espanola/2013	98	6.2	0.0310		0.52	0.029	2.9	200		3.9	0.180
Espanola/2015	19	2.3	0.0010	11000	0.33	0.019	2.2	62	240	1.2	0.029
Espanola/2015	54	4.8	0.0033	12000	0.47	0.045	2.5	98	280	2.8	0.100
Espanola/2015	63	3.5	0.0036	12000	0.37	0.039	2.2	130	260	2.1	0.076
Mean	34	3.2	0.0091	10433	0.30	0.035	2.87	95	340	2.7	0.079
Std Dev	26	1.4	0.0088	1031	0.09	0.013	0.83	36	67	1.3	0.039
RSRL	**113**	**7.6**	**0.0354**	**13528**	**0.58**	**0.075**	**5.38**	**205**	**542**	**6.5**	**0.196**

Table 2. Continued.

Location/Year	K	Na	V	Zn	Sb [e]	As	Cd	Pb	Se	Ag	Tl
Guaje Canyon/2007	3200	970	0.059	30		0.015	0.020		0.32	0.0038	0.0039
Guaje Canyon/2007	3400	850	0.085	110		0.055	0.030		0.26	0.0039	0.0030
Guaje Canyon/2007	3100	1700	0.093	27		0.018	0.013		0.23	0.0150	0.0020
Medanales/2008	2700	1100	0.053	28	0.0001	0.022	0.008	0.090	0.12	0.0007	0.0026
Medanales/2008	2800	1300	0.051	25	0.0002	0.016	0.015	0.340	0.21	0.0011	0.0021
San Ildefonso/2009	2900	920	0.018	25	0.039	0.068	0.027	0.056	0.28	0.0120	0.0007
San Ildefonso/2009	3000	920	0.007	25	0.04	0.031	0.013	0.041	0.25	0.0044	0.0005
San Ildefonso/2009	2800	1200	0.012	24	0.088	0.014	0.013	0.210	0.22	0.0026	0.0003
San Ildefonso/2009	2700	1200	0.020	26	0.099	0.037	0.013	0.066	0.24	0.0028	0.0014
Espanola/2013			0.086	49	0.091	0.017	0.021	0.170	0.28	0.0020	0.0020
Espanola/2013			0.160	57	0.049	0.025	0.007	0.230	0.16	0.0002	0.0023
Espanola/2013			0.260	73	0.061	0.036	0.021	0.410	0.23	0.0004	0.0030
Espanola/2015	3400	1500	0.035	120	0.034	0.076	0.010	0.130	0.35	0.0008	0.0014
Espanola/2015	3500	1500	0.110	110	0.021	0.041	0.022	1.100	0.35	0.0028	0.0035
Espanola/2015	3300	1600	0.120	88	0.031	0.025	0.010	0.300	0.16	0.0020	0.0020
Mean	3067	1230	0.078	54	0.046	0.033	0.016	0.262	0.24	0.0036	0.0020
Std Dev	278	279	0.065	35	0.032	0.019	0.007	0.277	0.06	0.0041	0.0010
RSRL	**3900**	**2066**	**0.272**	**159**	**0.141**	**0.090**	**0.036**	**1.093**	**0.44**	**0.0159**	**0.0051**

Table 2. Continued.

Location/Year	Hg [f]
Guaje Canyon/2007	0.0050
Guaje Canyon/2007	0.0068
Guaje Canyon/2007	0.0044
Medanales/2008	0.0004
Medanales/2008	0.0002
San Ildefonso/2009	0.0048
San Ildefonso/2009	0.0043
San Ildefonso/2009	0.0026
San Ildefonso/2009	0.0089
Espanola/2013	0.0040
Espanola/2013	0.0038
Espanola/2013	0.0043
Espanola/2015	0.0040
Espanola/2015	0.0043
Espanola/2015	0.0037
Mean	0.0041
Std Dev	0.0021
RSRL	**0.010**

[a]A sample consists of one whole body animal.

[b]Analyses conducted by ALS. Undetected values (<Method Detection Limit) were reported as 1/2 the MDL.

[c]Guaje Canyon (grassland) is located about 5 miles north of LANL; Medanales (grassland) is located about 25 miles north of LANL San Ildefonso is located about seven miles northeast of LANL on the east side of the Rio Grande, and Espanola (arroyos) is located approximately 20 miles N of LANL..

[d]Al to Zn by method SW6010B and analyzed by inductively coupled plasma.

[e]Sb to Tl by method SW6020B and analyzed by inductively coupled plasma/mass spectrometry.

[f]Hg by method SW7471 and analyzed by cold vapor atomic adsorption.

Table 3. Concentrations (pg/g wet) of PCB Congeners in (Whole Body) Field Mice Collected from Regional Background Locations.[a]

	Total PCB Homolog										
Year/Location[b]	**monoCB**	**diCB**	**triCB**	**tetraCB**	**pentaCB**	**hexaCB**	**heptaCB**	**octaCB**	**nonaCB**	**decaCB**	**Total PCB**
2007											
Medanales	0	11	0	0	8.5	32	15	3.1	0	0	69
Medanales	0	8.6	0	0	3.8	43	34	19	0	4.5	113
Medanales	0	47	0	0	5.4	135	140	93	73	36	530
Medanales	0	8.8	0	0	6.1	93	76	49	28	13	274
2008											
San Ildefonso	0	41	0	0	12	115	154	106	21	6.9	457
San Ildefonso	0	234	12	1	22	85	88	24	10	7.1	483
San Ildefonso	0	29	0	0	8.1	59	70	87	16	0	270
San Ildefonso	0	0	0	0	20	153	169	84	12	0	448
2011											
Nambe	0	0	0	0	0	0	0	0	0	0	2.8
2013											
Espanola	0	0	0	0	7.2	131	145	240	118	26	667
Espanola	0	266	430	157	29	121	48	6.2	0	0	1060
Espanola	0	0	0	0	5.5	130	113	61	15	0	324
2015											
Espanola	0	0	1.7	16	248	2310	1460	483	279	39	4830
Espanola	0	0	4.9	81	848	3100	1690	484	127	125	6500
Espanola	0	0	1.5	4.5	45	200	150	44	43	41	528
Mean	0	43	30	17	85	447	290	119	49	20	1104
SD	0	83	107	42	213	899	508	154	73	32	1832
RSRL	0	291	351	145	722	3143	1815	582	269	115	6600

[a]2007 and 2008 analysis conducted by Vista Analytical; 2011-2015 analysis conducted by Cape Fear.
[b]M=Medanales (grassland), NM; SI=San Ildefonso (grassland), NM; N=Nambe (garden), NM; E=Espanola, NM (arroyo)

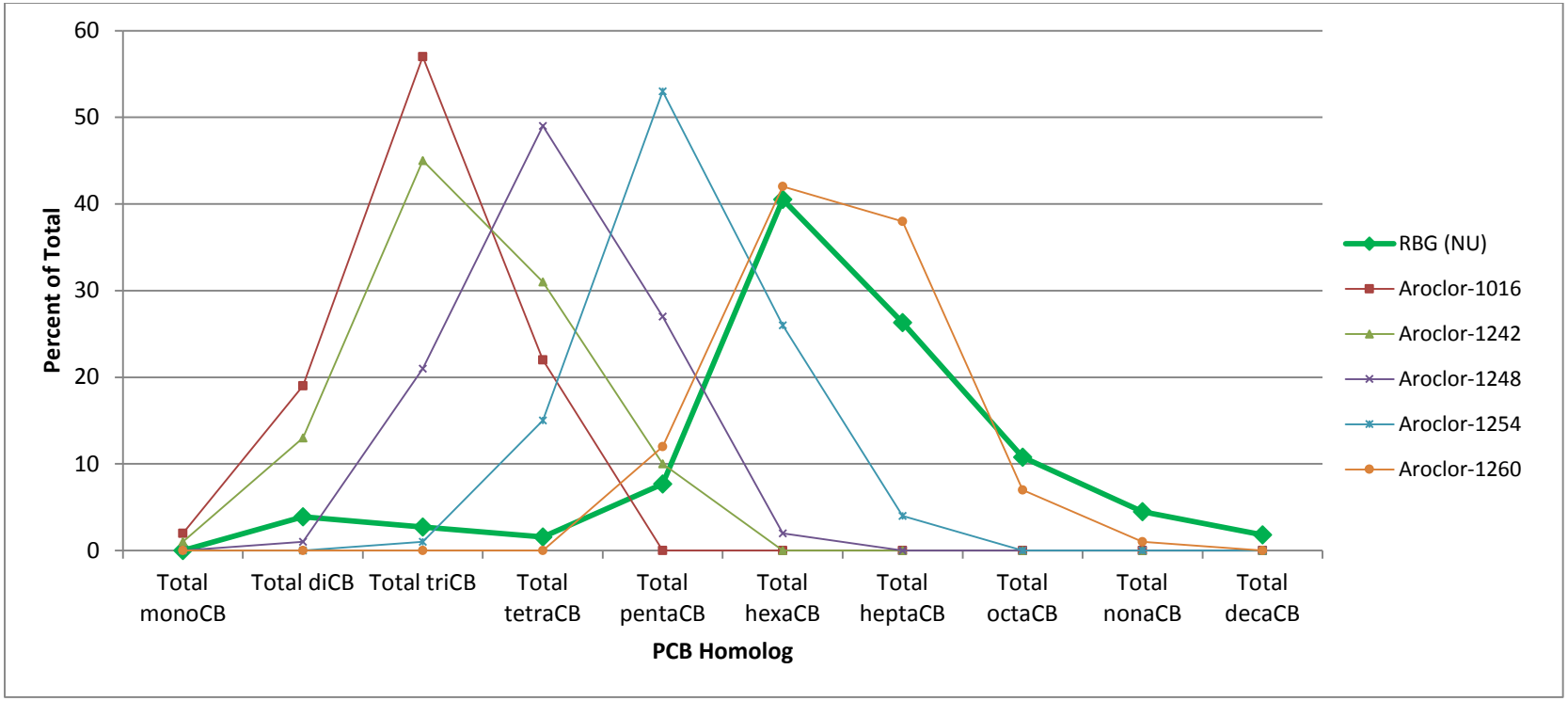

Figure 1. The mean homolog distribution (as percent of total) in (whole-body) field mice (n=15) collected from regional background locations compared with some of the major Aroclors manufactured in the U.S.

Table 4. Concentrations (pg/g wet) of PCB Congeners in (Whole Body) Field Mice Collected from Regional Background Locations Associated with an Urban Site in Espanola, NM.[a]

	Locations				
PCB Homolog	**E**	**E**	***Mean***	***Std Dev***	***RSRL***
Total monoCB	0	0	0		
Total diCB	0	0	0		
Total triCB	0	0	0		
Total tetraCB	0	0	0		
Total pentaCB	1080	18.7	549		
Total hexaCB	1640	216	928		
Total heptaCB	219	2430	1325		
Total octaCB	0	3860	1930		
Total nonaCB	0	5510	2755		
Total decaCB	0	445	223		
Total PCB	2940	12500	7720	6760	**28000**

[a]Analysis conducted by Cape Fear Analytical.

[b]E=Espanola, NM (Waste Transfer Station, Urban Park)

Table 5. High Explosives (µg/kg wet) and Perchlorate (mg/kg wet) in Whole-Body Field Mice Collected from Regional Background Locations Associated with Nonurban (M and N) and Urban (E) Sites[a]

High Explosives/Perchlorate	RL[b]	M[c]	M	N[c]	E[c]	Mean	Std Dev	RSRL
2,4-Diamino-6-nitrotoluene	2000	U[d]	U	U	U			
2,6-Diamino-4-nitrotoluene	2000	U	U	U	U			
3,5-Dinitroaniline	1000	U	U	U	U			
Amino-2,6-dinitrotoluene[4-]	500	U	U	U	U			
Amino-4,6-dinitrotoluene[2-]	500	U	U	U	U			
Dinitrobenzene[1,3-]	500	U	U	U	U			
Dinitrotoluene[2,4-]	500	U	U	U	U			
Dinitrotoluene[2,6-]	500	U	U	U	U			
HMX	500	U	U	U	U			
Nitrobenzene	500	U	U	U	U			
Nitrotoluene[2-]	500	U	U	U	U			
Nitrotoluene[3-]	500	U	U	U	U			
Nitrotoluene[4-]	500	U	U	U	U			
PETN	1000	U	U	U	U			
RDX	500	U	U	U	U			
TATB	1000	U	U	U	U			
Tetryl	500	U	U	U	U			
Trinitrobenzene[1,3,5-]	500	U	U	U	U			
Trinitrotoluene[2,4,6-]	500	U	U	U	U			
Tris (o-cresyl) phosphate	1000	U	U	U	U			

Table 5. Continued

High Explosives/Perchlorate	RL[b]	M[c]	M	N[c]	E[c]	Mean	Std Dev	RSRL
Perchlorate[e]	0.0040	0.016	0.0047	0.022	0.11	0.039	0.049	0.19

[a]Analysis conducted by General Engineering Laboratories, Inc.
[b]Reporting level (standard quantification limit).
[c]M=Medanales, N=Nambe, E=Española, New Mexico
[d]Laboratory qualifier. U (undetected)=result was below the minimum detectable level.
[e]Holding times were exceeded for perchlorate.

Table 6. Dioxin and Furan Concentrations (pg/g wet) in Whole-Body Field Mouse Samples Collected from Regional Background Locations Associated with Nonurban (M and N) and Urban (E) Sites[a]

Dioxin/Furan[a]	M[b]	RQ[c]	M	RQ	N[b]	RQ	N	RQ	N	RQ
Dioxins										
Tetrachlorodibenzodioxin[2,3,7,8-]	0.16	U	0.146	U	0.15	U	0.176	U	0.154	U
Tetrachlorodibenzodioxins (Total)	0.16	U	0.146	U	0.15	U	0.176	U	0.154	U
Pentachlorodibenzodioxin[1,2,3,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Pentachlorodibenzodioxins (Total)	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzodioxins (Total)	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	0.416	U	0.415	U	1.22	J	0.661	J	4.37	
Heptachlorodibenzodioxins (Total)	0.416	U	0.415	U	2.46	J	2.04	J	6.54	
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	1.12	J	1.19	J	6.89	J	4.43	J	23.9	
Furans										
Tetrachlorodibenzofuran[2,3,7,8-]	0.216	U	0.302	J	0.261	U	0.232	J	0.231	J
Tetrachlorodibenzofurans (Total)	0.216	U	0.302	J	0.261	U	0.232	U	0.231	J

Table 6. Continued

Dioxin/Furan[a]	M[b]	RQ[c]	M	RQ	N[b]	RQ	N	RQ	N	RQ
Pentachlorodibenzofuran[1,2,3,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Pentachlorodibenzofuran[2,3,4,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Pentachlorodibenzofurans (Total)	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzofuran[1,2,3,4,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzofuran[1,2,3,6,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzofuran[1,2,3,7,8,9-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzofuran[2,3,4,6,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Hexachlorodibenzofurans (Total)	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	0.416	U	0.415	U	0.413	U	0.475	U	0.842	J
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	0.416	U	0.415	U	0.413	U	0.475	U	0.413	U
Heptachlorodibenzofurans (Total)	0.416	U	0.415	U	0.413	U	0.475	U	1.56	J
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	0.831	U	0.831	U	0.825	U	0.95	U	1.15	J

Table 6. Continued

Dioxin/Furan[a]	E[b]	RQ[c]	E	RQ	E	RQ	Mean[d]	Std Dev	RSRL
Dioxins									
Tetrachlorodibenzodioxin[2,3,7,8-]	0.141	U	0.153	U	0.165	U	0.078	0.0056	0.10
Tetrachlorodibenzodioxins (Total)	0.141	U	0.153	U	0.165	U	0.078	0.006	0.10
Pentachlorodibenzodioxin[1,2,3,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Pentachlorodibenzodioxins (Total)	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzodioxins (Total)	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	0.415	U	0.415	U	0.417	U	0.91	1.4	5.2
Heptachlorodibenzodioxins (Total)	0.415	U	0.415	U	0.417	U	1.5	2.2	8.2
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	0.87	J	0.829	U	0.833	U	4.9	8.0	29
Furans									
Tetrachlorodibenzofuran[2,3,7,8-]	0.206	U	0.232	U	0.257	U	0.17	0.075	0.40
Tetrachlorodibenzofurans (Total)	0.206	U	0.232	U	0.345	J	0.18	0.10	0.47
Pentachlorodibenzofuran[1,2,3,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Pentachlorodibenzofuran[2,3,4,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Pentachlorodibenzofurans (Total)	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24

Table 6. Continued

Dioxin/Furan[a]	E[b]	RQ[c]	E	RQ	E	RQ	Mean[d]	Std Dev	RSRL
Hexachlorodibenzofuran[1,2,3,4,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzofuran[1,2,3,6,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzofuran[1,2,3,7,8,9-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzofuran[2,3,4,6,7,8-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Hexachlorodibenzofurans (Total)	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	0.415	U	0.415	U	0.417	U	0.29	0.22	0.96
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	0.415	U	0.415	U	0.417	U	0.21	0.011	0.24
Heptachlorodibenzofurans (Total)	0.415	U	0.415	U	0.417	U	0.38	0.48	1.8
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	0.831	U	0.829	U	0.833	U	0.51	0.26	1.30

[a]Analysis conducted by Cape Fear Analytical; method-blank corrected data.
[b]M=Medanales (grassland site), N=Nambe (grassland site), E=Española (urban site).
[c]Results as related to the reporting qualifier (RQ):
Result followed by a blank space is a detected value=result was above the reporting limit;
Result followed by a U is an undetected value=result was below the minimum detectable level (MDL) (shown);
Result followed by a J is an estimated value=result was above the MDL but below the reporting level.
[d]To obtain statistics, all MDL (U) data were divided by one-half.

REFERENCES

Arthur, W.J., O.D. Markham, C.R. Groves, and B.L. Keller. 1987. "Radionuclide Export by Deer Mice at a Solid Radioactive Waste Disposal Area in Southeastern Idaho," Health Physics, 52(1).

Bennett, K.D., J.R. Biggs, and P.R. Fresquez. 1996. "Radionuclide Contaminant Analysis of Small Mammals at Area G, TA-54, 1995," Los Alamos National Laboratory report LA-13242-MS.

Biggs, J.R., K.D. Bennett, and P.R. Fresquez. 1995. "Radionuclide Contaminant Analysis of Small Mammals at Area G, TA-54, 1994," Los Alamos National Laboratory report LA-13105-MS.

DOE (U.S. Department of Energy). 1991. "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," U.S. Department of Energy report DOE/EH-0173T.

DOE (U.S. Department of Energy). 2011a. "Departmental Sustainability," U.S. Department of Energy Order 436.1 (May 2, 2011).

DOE (U.S. Department of Energy). 2011b. "Radiation Protection of the Public and the Environment," U.S. Department of Energy Order 458.1 (February 11, 2011).

Fresquez, P.R., C. Hathcock, D. Keller, and G.J. Gonzales. 2009. "Foodstuffs and Biota Monitoring," in Environmental Surveillance at Los Alamos during 2008, Los Alamos National Laboratory report LA-14407-ENV, pp. 267–296.

Fresquez, P.R., L. Hansen, and C. Hathcock. 2013. Chemical Concentrations in Field Mice/Voles Collected from an Open-Burn Site at Technical Area 16 at Los Alamos National Laboratory: Revision 1. Los Alamos National Laboratory report LA-UR-13-20040.

Fresquez, P.R. 2014. Polychlorinated Biphenyls in Whole-Body Field Mice Collected Upgradient and Downgradient of a Sediment Retention Structure in Los Alamos Canyon, Los Alamos National Laboratory, New Mexico, USA. Journal of Environmental Protection, 5(2): 96-105.

McNaughton, M. 2006. "Calculating Dose to Non-Human Biota," ENV-MAQ-514, R1.

Talmage, S.S. and B.T. Walton. 1991. Small Mammals as Monitors of Environmental Contaminants. Reviews of Environmental Contamination and Toxicology 119:47–145.

Wood, B.A., L. Cao, and M.D. Dearing. 2010. Deer Mouse (*Peromyscus maniculatus*) Home-Range Size and Fidelity in Sage-Steppe Habitat. Western North American Naturalist 70(3): 345–354.