

Response to NDEP Comments Dated January 29, 2008 on Advisement Regarding Radionuclide Analyses and NDEP Comments Dated January 31, 2008 on BRC Response to December 7 2007 Letter Advisement Regarding Radionuclides Analyses for Uranium

1. Regarding new radionuclide data, the Companies must utilize radionuclide methods that are the same as the methods employed in the BRC/TIMET shallow soils background data set. This will insure comparability without unnecessary confusion or justifications. The Companies must insure that preparatory (prep) methods and analytical procedures produce comparable data. Failure to do so in future data sets will result in rejection of data. If a Company's QAPP requires additional modification, please advise the NDEP by February 29, 2008.

Response: BRC has revised the QAPP to ensure that methods used for radionuclides are the same as those used for the shallow background dataset. That is, total dissolution methods for both thoriums and uraniums, and alpha-spec for Ra-226 and beta emission analysis for Ra-228. BRC will use these methods for all future investigations. A revised Table 4 from BRC's QAPP is attached. In addition, an electronic copy of the entire QAPP will be provided to NDEP in the near future. [Note: this response also applies to NDEP's letter dated January 31, 2008]

2. Regarding new data, please note that the NDEP does not approve of the use of gamma spectroscopy (spec) for the analysis of Radium-228(Ra-228), or any other radionuclide.

Response: See response to comment #1 above.

3. Regarding existing data, it is noted that both ICP and ICP/MS methods have been used for the analyses of metals. It is noted that the ICP/MS data is more sensitive, however, the methods are comparable.

Response: Where possible BRC uses the ICP/MS method (6020) for the analysis of metals. In some cases, usually due to interferences, Method 6010 is used. Also, it should be noted that the methodologies for lithium and sulfur have not been developed for the ICP/MS. Analysis of Performance Evaluation Standards, for these elements, via the ICP/MS, has not produced acceptable results. Therefore the laboratory utilizes the ICP - 6010 methodology and instrumentation for lithium and sulfur.

4. Regarding existing data, the NDEP generally concurs with the methodology outlined by BRC in their letter dated January 10, 2008 for uranium. This method will be described below with exceptions noted by the NDEP.
 - a. For historical data sets with compromised uranium data, background comparisons should first be made to uranium as a metal. If these background comparisons pass, nothing further is required.
 - b. If the metallic uranium background comparisons fail, isotope-specific correction factors must be developed and applied in order to quantitate risk. Please note that isotopic correction factors will need to be developed (or verified) separately for each data set (by

sub-area, parcel, site, etc.) because of the potential for analytic and geologic differences between sub-areas or sites.

- c. While the NDEP's original request was directed at uranium, it appears that some data sets may have other radionuclides that are not comparable to background because of analytical issues (e.g.: thorium and radium isotopes). Additional discussion is provided below.
- d. Please note that if it is not reasonable to assume secular equilibrium, then correction factors cannot be applied, and re-analysis might be required.
- e. For example, the thorium isotopic data for Phase A at TRONOX are much lower than background. The reasons need to be expeditiously investigated and identified.
- f. For example, the Thorium-230 (Th-230), Uranium-234 (U-234) and Uranium-238 (U-238) data at BMI Parcel 4B are much lower than background. Again, the reasons need to be expeditiously investigated and identified.
- g. It is noted that correction factors could be developed for thorium based on an assumption of secular equilibrium with uranium (since uranium is also analyzed as a metal).
- h. Ra-226 and Ra-228 have been analyzed by gamma spec at some sites. It has not been demonstrated that these data are comparable with the background radium data that involved alpha-spec (Ra-226) and beta emission (Ra-228) analysis. The correlation needs to be demonstrated prior to use of historic gamma spec data for radium isotopes.
- i. In particular, TIMET has noted that some data sets contain Ra-228 data by gamma spectroscopy. TIMET has proposed to compare these data to gamma spectroscopy data collected for the background data set to attempt to develop a correlation factor. To date, TIMET has not been able to develop a statistical relationship upon which a correlation factor can be developed. Hence, it is not evident that this will be possible. This issue requires further discussion among the Companies. This issue could be addressed in several ways.
 - i. Back quantitation of Ra-228 from a parent radionuclide (if the parent radionuclide data are comparable with background).
 - ii. Use of a correlation factor if developable.
 - iii. The NDEP is amenable to other suggestions by the Companies.
- j. In addition, TIMET has noted that there may be differences between the site data set for lead-210 (Pb-210) and the background data set. These differences need to be expeditiously investigated and identified. It is expected that TIMET will respond to this issue by February 29, 2008.
- k. The remaining Companies with radionuclide data should affirm that their data sets do not have any comparability issues with regards to Pb-210 (or any other compound). This affirmation is required by February 29, 2008.

Response: Recent sampling and analyses have focused on eight radionuclides: radium-226, radium-228, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235/236, and uranium-238. Therefore, there should be no comparability issues with regard to lead-210. As noted above in response to comment #1, BRC has revised the QAPP to ensure that methods used for radionuclides are the same as those used for the shallow background dataset.

TABLE 4
PROJECT LIST OF ANALYTES
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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Ions	EPA 300.0A		EPA 300.0A		Bromide	24959-67-9	2.5	mg/kg	0.25	mg/L
					Bromine	7726-95-6	1	mg/kg	0.5	mg/L
					Chlorate	14866-68-3	5	mg/kg	0.5	mg/L
					Chloride	16887-00-6	2	mg/kg	0.2	mg/L
					Chlorine (soluble)	7782-50-5	NA	mg/kg	0.5	mg/L
					Chlorite	14998-27-7	NA	mg/kg	0.02	mg/L
					Fluoride	16984-48-8	1	mg/kg	0.1	mg/L
					Nitrate (as N)	14797-55-8	0.2	mg/kg	0.02	mg/L
					Nitrite (as N)	14797-65-0	0.2	mg/kg	0.02	mg/L
					Orthophosphate	14265-44-2	5	mg/kg	0.5	mg/L
					Sulfate	14808-79-8	5	mg/kg	0.5	mg/L
	EPA 377.1		EPA 377.1		Sulfite	14265-45-3	5	mg/kg	0.5	mg/L
	EPA 314.0		EPA 314.0		Perchlorate	14797-73-0	40	ug/kg	4	µg/L
Dissolved Gases	NA		NA	RSK 175	Ethane	74-84-0	NA	NA	5	µg/L
					Ethylene	74-85-1	NA	NA	5	µg/L
					Methane	74-82-8	NA	NA	5	µg/L
Chlorinated Compounds	EPA 551.1		EPA 551.1		Chloral	75-87-6	70	µg/kg	3	µg/L
					Dichloroacetaldehyde	79-02-7	70	µg/kg	20	µg/L
Polychlorinated Dibenzo-dioxins/ Dibenzofurans	EPA 8290		EPA 8290		1,2,3,4,6,7,8,9-Octachlorodibenzofuran	39001-02-0	10	pg/g	100	pg/L
					1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	3268-87-9	10	pg/g	100	pg/L
					1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	5	pg/g	50	pg/L
					1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9	5	pg/g	50	pg/L
					1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	5	pg/g	50	pg/L
					1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	5	pg/g	50	pg/L
					1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	5	pg/g	50	pg/L
					1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	5	pg/g	50	pg/L
					1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	5	pg/g	50	pg/L
					1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	5	pg/g	50	pg/L
					1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	5	pg/g	50	pg/L
					1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	5	pg/g	50	pg/L
					1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4	5	pg/g	50	pg/L
					2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	5	pg/g	50	pg/L
					2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	5	pg/g	50	pg/L
					2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	1	pg/g	10	pg/L
					2,3,7,8-Tetrachlororodibenzo-p-dioxin	1746-01-6	1	pg/g	10	pg/L
Asbestos	Elutrador	NA	TEM	NA	Asbestos	1332-21-4	1	fibers/cm ³	NA	NA

TABLE 4
PROJECT LIST OF ANALYTES
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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
General Chemistry Parameters	EPA 350.1		EPA 350.1		Ammonia (as N)	7664-41-7	5	mg/kg	50	µg/L
	EPA 9012A		EPA 9012A		Cyanide (Total)	57-12-5	5	mg/kg	5	µg/L
	EPA 9056M	EPA 300.0A	EPA 9056M	EPA 300.0A	Iodine	7553-56-2	5	mg/kg	1	mg/L
	NA		EPA 9045C	EPA 9040B	pH in soil	pH	NA	pHunits	NA	pHunits
	EPA 160.3M	NA	EPA 160.3M	NA	Percent moisture	%MOISTURE		percent	NA	NA
	ASTM D2216-98	NA	ASTM D2216-98	NA	Percent moisture	%MOISTURE		percent	NA	NA
	EPA 376.1/376.2		EPA 376.1/376.2		Sulfide	18496-25-8	10	mg/kg	1	mg/L
	Mod. EPA 415.1		EPA 9060		Total inorganic carbon	7440-44-0	NA	mg/kg	1	mg/L
	EPA 351.2		EPA 351.2		Total Kjeldahl nitrogen (TKN)	TKN	25	mg/kg	0.1	mg/L
Metals	EPA 9060		EPA 9060		Total organic carbon (TOC)	7440-44-0	25	mg/kg	1	mg/L
	EPA 3050M	EPA 3010M	EPA 6020/6010B		Aluminum	7429-90-5	5	mg/kg	30	µg/L
					Antimony	7440-36-0	0.5	mg/kg	5	µg/L
					Arsenic	7440-38-2	1	mg/kg	10	µg/L
					Barium	7440-39-3	2	mg/kg	2	µg/L
					Beryllium	7440-41-7	0.1	mg/kg	0.5	µg/L
					Boron	7440-42-8	10	mg/kg	50	µg/L
					Cadmium	7440-43-9	0.05	mg/kg	0.5	µg/L
					Calcium	7440-70-2	50	mg/kg	100	µg/L
					Chromium	7440-47-3	1	mg/kg	10	µg/L
					Cobalt	7440-48-4	0.2	mg/kg	2	µg/L
					Copper	7440-50-8	1	mg/kg	1	µg/L
					Iron	7439-89-6	5	mg/kg	50	µg/L
					Lead	7439-92-1	0.3	mg/kg	3	µg/L
					Lithium	1313-13-9	5	mg/kg	50	µg/L
					Magnesium	7439-95-4	50	mg/kg	50	µg/L
					Manganese	7439-96-5	0	mg/kg	2	µg/L
					Molybdenum	7439-98-7	1	mg/kg	5	µg/L
					Nickel	7440-02-0	1	mg/kg	5	µg/L
					Niobium	7440-03-1	3	mg/kg	25	µg/L
					Palladium	7440-05-3	0.1	mg/kg	0.5	µg/L
					Phosphorus	7723-14-0	50	mg/kg	20	µg/L
					Platinum	7440-06-4	0.1	mg/kg	1	µg/L
					Potassium	7440-09-7	10	mg/kg	100	µg/L
					Selenium	7782-49-2	0.5	mg/kg	5	µg/L
					Silicon	7440-21-3	25	mg/kg	250	µg/L
					Silver	7440-22-4	0.2	mg/kg	2	µg/L
					Sodium	7440-23-5	20	mg/kg	50	µg/L
					Strontium	7440-24-6	0.5	mg/kg	5	µg/L
					Sulfur	7704-34-9	500	mg/kg	2000	µg/L

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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Metals (continued)	EPA 3050M	EPA 3010M	EPA 6020/6010B		Thallium	7440-28-0	0.2	mg/kg	2	µg/L
					Tin	7440-31-5	0.2	mg/kg	2	µg/L
					Titanium	7440-32-6	0.5	mg/kg	2	µg/L
					Tungsten	7440-33-7	0.5	mg/kg	5	µg/L
					Uranium	7440-61-1	0.1	mg/kg	1	µg/L
					Vanadium	7440-62-2	1.0	mg/kg	10	µg/L
					Zinc	7440-66-6	2	mg/kg	10	µg/L
					Zirconium	7440-67-7	10	mg/kg	5	µg/L
		EPA 3060A		EPA 7196A		Chromium (VI)	18540-29-9	0.4	mg/kg	10
	EPA 7471A	EPA 7470A	EPA 7471A	EPA 7470A	Mercury	7439-97-6	0.0333	mg/kg	0.2	µg/L
Organo-phosphorous Pesticides	EPA 8141A		EPA 8141A		Azinphos-ethyl	264-27-19	33	µg/kg	0.7	µg/L
					Azinphos-methyl	86-50-0	13	µg/kg	2.5	µg/L
					Carbophenothion	786-19-6	33	µg/kg	0.6	µg/L
					Chlorpyrifos	2921-88-2	20	µg/kg	1.5	µg/L
					Coumaphos	56-72-4	13	µg/kg	1	µg/L
					Demeton-O	298-03-3	39	µg/kg	1	µg/L
					Demeton-S	126-75-0	15	µg/kg	1	µg/L
					Diazinon	333-41-5	22	µg/kg	0.5	µg/L
					Dichlorvos	62-73-7	23	µg/kg	0.5	µg/L
					Dimethoate	60-51-5	22	µg/kg	1.5	µg/L
					Disulfoton	298-04-4	48	µg/kg	0.5	µg/L
					EPN	2104-64-5	13	µg/kg	1.2	µg/L
					Ethoprop	13194-48-4	15	µg/kg	1.5	µg/L
					Ethyl parathion	56-38-2	18	µg/kg	1	µg/L
					Fampphur	52-85-7	13	µg/kg	1	µg/L
					Fenthion	55-38-9	33	µg/kg	2.5	µg/L
					Malathion	121-75-5	15	µg/kg	2	µg/L
					Methyl carbophenothion	953-17-3	33	µg/kg	0.8	µg/L
					Methyl parathion	298-00-0	20	µg/kg	4	µg/L
					Mevinphos	7786-34-7	15	µg/kg	6.2	µg/L
					Naled	300-76-5	70	µg/kg	2	µg/L
					O,O,O-Triethyl phosphorothioate (TEPP)	297-97-2	39	µg/kg	0.5	µg/L
					Phorate	298-02-2	20	µg/kg	1.2	µg/L
					Phosmet	732-11-6	67	µg/kg	1.5	µg/L
					Ronnel	299-84-3	46	µg/kg	10	µg/L
					Stiropfos (Tetrachlorovinphos)	22248-79-9	15	µg/kg	3.5	µg/L
					Sulfotep	3689-24-5	20	µg/kg	1.5	µg/L

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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Chlorinated Herbicides	EPA 8151A		EPA 8151A		2,4,5-T	93-76-5	20	µg/kg	1	µg/L
					2,4,5-TP (Silvex)	93-72-1	20	µg/kg	1	µg/L
					2,4-D	94-75-7	80	µg/kg	4	µg/L
					2,4-DB	94-82-6	80	µg/kg	4	µg/L
					Dalapon	75-99-0	40	µg/kg	4	µg/L
					Dicamba	1918-00-9	40	µg/kg	2	µg/L
					Dichloroprop	120-36-5	80	µg/kg	4	µg/L
					Dinoseb	88-85-7	25	µg/kg	0.6	µg/L
					MCPA	94-74-6	8000	µg/kg	400	µg/L
					MCPP	93-65-2	8000	µg/kg	400	µg/L
Organic Acids	HPLC		HPLC		4-Chlorobenzene sulfonic acid	98-66-8	0.4	mg/Kg	0.4	mg/L
					Benzenesulfonic acid	98-11-3	0.4	mg/Kg	0.4	mg/L
					O,O-Diethylphosphorodithioic acid	298-06-6	0.4	mg/Kg	0.4	mg/L
					O,O-Dimethylphosphorodithioic acid	756-80-9	0.4	mg/Kg	0.1	mg/L
Nonhalogenated Organics	EPA 8015B		EPA 8015B		Ethylene glycol	107-21-1	50	mg/kg	10	mg/L
					Ethylene glycol monobutyl ether	111-76-2	50	mg/kg	10	mg/L
					Methanol	67-56-1	50	mg/kg	5	mg/L
					Propylene glycol	57-55-6	50	mg/kg	10	mg/L
Organochlorine Pesticides	EPA 3550B	EPA 3520C	EPA 8081A		2,4-DDD	53-19-0	1.7	µg/kg	0.05	µg/L
					2,4-DDE	3424-82-6	1.7	µg/kg	0.05	µg/L
					4,4-DDD	72-54-8	1.7	µg/kg	0.05	µg/L
					4,4-DDE	72-55-9	1.7	µg/kg	0.05	µg/L
					4,4-DDT	50-29-3	1.7	µg/kg	0.05	µg/L
					Aldrin	309-00-2	1.7	µg/kg	0.05	µg/L
					alpha-BHC	319-84-6	1.7	µg/kg	0.05	µg/L
					alpha-Chlordane	5103-71-9	1.7	µg/kg	0.05	µg/L
					beta-BHC	319-85-7	1.7	µg/kg	0.05	µg/L
					Chlordane	57-74-9	17	µg/kg	0.5	µg/L
					delta-BHC	319-86-8	1.7	µg/kg	0.05	µg/L
					Dieldrin	60-57-1	1.7	µg/kg	0.05	µg/L
					Endosulfan I	959-98-8	1.7	µg/kg	0.05	µg/L
					Endosulfan II	33213-65-9	1.7	µg/kg	0.05	µg/L
					Endosulfan sulfate	1031-07-8	1.7	µg/kg	0.05	µg/L
					Endrin	72-20-8	1.7	µg/kg	0.05	µg/L
					Endrin aldehyde	7421-93-4	1.7	µg/kg	0.05	µg/L
					Endrin ketone	53494-70-5	1.7	µg/kg	0.05	µg/L
					gamma-BHC (Lindane)	58-89-9	1.7	µg/kg	0.05	µg/L
					gamma-Chlordane	5103-74-2	1.7	µg/kg	0.05	µg/L

TABLE 4
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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Organochlorine Pesticides (continued)	EPA 3550B	EPA 3510C	EPA 8081A	Heptachlor	76-44-8	1.7	µg/kg	0.05	µg/L	
				Heptachlor epoxide	1024-57-3	1.7	µg/kg	0.05	µg/L	
				Methoxychlor	72-43-5	3.3	µg/kg	0.1	µg/L	
				Toxaphene	8001-35-2	67	µg/kg	2	µg/L	
Polychlorinated Biphenyls	EPA 3510C		EPA 8082	Aroclor 1016	12674-11-2	33	µg/kg	1	µg/L	
				Aroclor 1221	11104-28-2	33	µg/kg	1	µg/L	
				Aroclor 1232	11141-16-5	33	µg/kg	1	µg/L	
				Aroclor 1242	53469-21-9	33	µg/kg	1	µg/L	
				Aroclor 1248	12672-29-6	33	µg/kg	1	µg/L	
				Aroclor 1254	11097-69-1	33	µg/kg	1	µg/L	
				Aroclor 1260	11096-82-5	33	µg/kg	1	µg/L	
				PCB-77	32598-13-3	2	pg/g	20	pg/L	
				PCB-81	70362-50-4	2	pg/g	20	pg/L	
				PCB-105	32598-14-4	2	pg/g	20	pg/L	
				PCB-114	74472-37-0	2	pg/g	20	pg/L	
				PCB-118	31508-00-6	2	pg/g	20	pg/L	
				PCB-123	65510-44-3	2	pg/g	20	pg/L	
				PCB-126	57465-28-8	2	pg/g	20	pg/L	
				PCB-156	38380-08-4	2	pg/g	20	pg/L	
				PCB-157	69782-90-7	2	pg/g	20	pg/L	
				PCB-167	52663-72-6	2	pg/g	20	pg/L	
				PCB-169	32774-16-6	2	pg/g	20	pg/L	
				PCB-189	39635-31-9	2	pg/g	20	pg/L	
Polynuclear Aromatic Hydrocarbons	EPA 3550	EPA 3510C	EPA 8310 ¹	Acenaphthene	83-32-9	50	µg/kg	5	µg/L	
				Acenaphthylene	208-96-8	100	µg/kg	5	µg/L	
				Anthracene	120-12-7	30	µg/kg	5	µg/L	
				Benzo(a)anthracene	56-55-3	15	µg/kg	5	µg/L	
				Benzo(a)pyrene	50-32-8	15	µg/kg	5	µg/L	
				Benzo(b)fluoranthene	205-99-2	15	µg/kg	5	µg/L	
				Benzo(g,h,i)perylene	191-24-2	30	µg/kg	5	µg/L	
				Benzo(k)fluoranthene	207-08-9	15	µg/kg	5	µg/L	
				Chrysene	218-01-9	15	µg/kg	5	µg/L	
				Dibenzo(a,h)anthracene	53-70-3	30	µg/kg	5	µg/L	
				Indeno(1,2,3-cd)pyrene	193-39-5	15	µg/kg	5	µg/L	
				Phenanthrene	85-01-8	30	µg/kg	5	µg/L	
				Pyrene	129-00-0	30	µg/kg	5	µg/L	

TABLE 4
PROJECT LIST OF ANALYTES
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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Radionuclides	NA	EPA 900.0 or 9310	NA	EPA 900.0 or 9310	Gross alpha	G Alpha	10.0	pCi/g	3.0	pCi/L
					Gross beta	G Beta	10.0	pCi/g	4.0	pCi/L
	HASL 300 RC5013/5032 ² RC-5016 ² (Total Dissolution)	HASL A-01-R			Thorium-232	7440-29-1	1.0	pCi/g	1.0	pCi/L
					Thorium-228	14274-82-9	1.0	pCi/g	1.0	pCi/L
					Thorium-230	14269-63-7	1.0	pCi/g	1.0	pCi/L
					Uranium-233/234	13966-29-5	1.0	pCi/g	1.0	pCi/L
					Uranium 235/236	15117-96-1	1.0	pCi/g	1.0	pCi/L
					Uranium-238	7440-61-1	1.0	pCi/g	1.0	pCi/L
	HASL 300 RC-5013/RC-5032 ²		EPA 903.1	Radium-226	13982-63-3	1.0	pCi/g	1.0	pCi/L	
			EPA 904.0	Radium-228	15262-20-1	1.0	pCi/g	1.0	pCi/L	
	EPA 901.1/ HASL GA-01-R	EPA 901.1/ HASL GA-01-R		Actinium-228	14331-83-0	*	pCi/g	*	pCi/L	
				Bismuth-212	14913-49-6	*	pCi/g	*	pCi/L	
				Bismuth-214	14733-03-0	*	pCi/g	*	pCi/L	
				Cobalt-57	13981-50-5	*	pCi/g	*	pCi/L	
				Cobalt-60	10198-40-0	*	pCi/g	*	pCi/L	
				Lead-210	14255-04-0	*	pCi/g	*	pCi/L	
				Lead-211	015816-77-0	*	pCi/g	*	pCi/L	
				Lead-212	15092-94-1	*	pCi/g	*	pCi/L	
				Lead-214	15067-28-4	*	pCi/g	*	pCi/L	
				Potassium-40	13966-00-2	*	pCi/g	*	pCi/L	
				Thallium-208	14913-50-9	*	pCi/g	*	pCi/L	
				Thorium-227	15623-47-9	*	pCi/g	*	pCi/L	
				Thorium-234	15065-10-8	*	pCi/g	*	pCi/L	
			NA	Quantitate from Parent or Daughter Radionuclide		Actinium-227 (from Th-227)	14952-40-0	*	pCi/g	*
		Bismuth-210 (from Pb-210)			14331-79-4	*	pCi/g	*	pCi/L	
		Bismuth-211 (from Pb-211)			15229-37-5	*	pCi/g	*	pCi/L	
		Polonium-210 (from Pb-210)			13981-52-7	*	pCi/g	*	pCi/L	
		Polonium-212 (from Bi-212)			13981-52-7	*	pCi/g	*	pCi/L	
		Polonium-214 (from Bi-214)			15735-67-8	*	pCi/g	*	pCi/L	
		Polonium-216 (from Pb-212)			15756-58-8	*	pCi/g	*	pCi/L	
		Polonium-218 (from Pb-214)			15422-74-9	*	pCi/g	*	pCi/L	
		Protactinium-231 (from U-235)			14331-85-2	*	pCi/g	*	pCi/L	
		Protactinium-234 (from Th-234)			15100-28-4	*	pCi/g	*	pCi/L	
		Radium-223 (from Th-227)			15623-45-7	*	pCi/g	*	pCi/L	
		Radium-224 (from Pb-212)			13233-32-4	*	pCi/g	*	pCi/L	
		Thallium-207 (from Pb-211)			14133-67-6	*	pCi/g	*	pCi/L	
		Thorium-231 (from U-235)			14932-40-2	*	pCi/g	*	pCi/L	

TABLE 4
PROJECT LIST OF ANALYTES
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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Radon	NA		FLUX	NA	Radon-220	22481-48-7	0.1 (Air)	pCi/L	NA	pCi/L
					Radon-222	14859-67-7	0.1 (Air)	pCi/L	NA	pCi/L
Aldehydes	EPA 8315A		EPA 8315A		Acetaldehyde	75-07-0	500	µg/kg	30	µg/L
					Chloroacetaldehyde	107-20-0	1000	µg/kg	10	µg/L
					Dichloroacetaldehyde	79-02-7	1000	µg/kg	10	µg/L
					Formaldehyde	50-00-0	1000	µg/kg	60	µg/L
					Trichloroacetaldehyde	75-87-6	1000	µg/kg	10	µg/L
Semivolatile Organic Compounds	EPA 3550B	EPA 3510C	EPA 8270C ³		1,2,4,5-Tetrachlorobenzene	95-94-3	330	µg/kg	10	µg/L
					1,2-Diphenylhydrazine	122-66-7	330	µg/kg	10	µg/L
					1,4-Dioxane	123-91-1	330	µg/kg	10	µg/L
					2,2'/4,4'-Dichlorobenzil	3457-46-3	330	µg/kg	10	µg/L
					2,4,5-Trichlorophenol	95-95-4	330	µg/kg	10	µg/L
					2,4,6-Trichlorophenol	88-06-2	330	µg/kg	10	µg/L
					2,4-Dichlorophenol	120-83-2	330	µg/kg	10	µg/L
					2,4-Dimethylphenol	105-67-9	330	µg/kg	10	µg/L
					2,4-Dinitrophenol	51-28-5	1600	µg/kg	50	µg/L
					2,4-Dinitrotoluene	121-14-2	330	µg/kg	10	µg/L
					2,6-Dinitrotoluene	606-20-2	330	µg/kg	10	µg/L
					2-Chloronaphthalene	91-58-7	330	µg/kg	10	µg/L
					2-Chlorophenol	95-57-8	330	µg/kg	10	µg/L
					2-Methylnaphthalene	91-57-6	330	µg/kg	10	µg/L
					2-Nitroaniline	88-74-4	1600	µg/kg	50	µg/L
					2-Nitrophenol	88-75-5	330	µg/kg	10	µg/L
					3,3-Dichlorobenzidine	91-94-1	1600	µg/kg	50	µg/L
					3-Nitroaniline	99-09-2	1600	µg/kg	50	µg/L
					4,4'-Dichlorobenzil	3457-46-3	330	µg/kg	10	µg/L
					4-Bromophenyl phenyl ether	101-55-3	330	µg/kg	10	µg/L
					4-Chloro-3-methylphenol	59-50-7	330	µg/kg	10	µg/L
					4-Chlorophenyl phenyl ether	7005-72-3	330	µg/kg	10	µg/L
					4-Chlorothioanisole	123-09-1	1600	µg/kg	50	µg/L
					4-Chlorothiophenol	106-54-7	330	µg/kg	10	µg/L
					4-Nitroaniline	100-01-6	1600	µg/kg	50	µg/L
					4-Nitrophenol	100-02-7	1600	µg/kg	50	µg/L
					Acenaphthene	83-32-9	330	µg/kg	10	µg/L
					Acenaphthylene	208-96-8	330	µg/kg	10	µg/L
					Acetophenone	98-86-2	330	µg/kg	10	µg/L
					Aniline	62-53-3	330	µg/kg	10	µg/L

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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Semivolatile Organic Compounds (continued)	EPA 3550B	EPA 3510C	EPA 8270C ³		Anthracene	120-12-7	330	µg/kg	10	µg/L
					Azobenzene	103-33-3	330	µg/kg	10	µg/L
					Benzo(a)anthracene	56-55-3	330	µg/kg	10	µg/L
					Benzo(a)pyrene	50-32-8	330	µg/kg	10	µg/L
					Benzo(b)fluoranthene	205-99-2	330	µg/kg	10	µg/L
					Benzo(g,h,i)perylene	191-24-2	330	µg/kg	10	µg/L
					Benzo(k)fluoranthene	207-08-9	330	µg/kg	10	µg/L
					Benzoic acid	65-85-0	1600	µg/kg	50	µg/L
					Benzyl alcohol	100-51-6	330	µg/kg	10	µg/L
					bis(2-Chloroethoxy)methane	111-91-1	330	µg/kg	10	µg/L
					bis(2-Chloroethyl) ether	111-44-4	330	µg/kg	10	µg/L
					bis(2-Chloroisopropyl) ether	108-60-1	330	µg/kg	10	µg/L
					bis(2-Ethylhexyl) phthalate	117-81-7	330	µg/kg	10	µg/L
					bis(Chloromethyl) ether	542-88-1	330	µg/kg	10	µg/L
					bis(p-Chlorophenyl) sulfone	80-07-9	330	µg/kg	10	µg/L
					bis(p-Chlorophenyl)disulfide	1142-19-4	330	µg/kg	10	µg/L
					Butylbenzyl phthalate	85-68-7	330	µg/kg	10	µg/L
					Carbazole	86-74-8	330	µg/kg	10	µg/L
					Chrysene	218-01-9	330	µg/kg	10	µg/L
					Dibenzo(a,h)anthracene	53-70-3	330	µg/kg	10	µg/L
					Dibenzofuran	132-64-9	330	µg/kg	10	µg/L
					Dichloromethyl ether	542-88-1	330	µg/kg	10	µg/L
					Diethyl phthalate	84-66-2	330	µg/kg	10	µg/L
					Dimethyl phthalate	131-11-3	330	µg/kg	10	µg/L
					Di-n-butyl phthalate	84-74-2	330	µg/kg	10	µg/L
					Di-n-octyl phthalate	117-84-0	330	µg/kg	10	µg/L
					Diphenyl disulfide	882-33-7	330	µg/kg	10	µg/L
					Diphenyl sulfide	139-66-2	330	µg/kg	10	µg/L
					Diphenyl sulfone	127-63-9	330	µg/kg	10	µg/L
					Fluoranthene	206-44-0	330	µg/kg	10	µg/L
					Fluorene	86-73-7	330	µg/kg	10	µg/L
					Hexachlorobenzene	118-74-1	330	µg/kg	50	µg/L
					Hexachlorobutadiene	87-68-3	330	µg/kg	50	µg/L
					Hexachlorocyclopentadiene	77-47-4	1600	µg/kg	50	µg/L
					Hexachloroethane	67-72-1	330	µg/kg	10	µg/L
					Hydroxymethyl phthalimide	118-29-6	330	µg/kg	10	µg/L
					Indeno(1,2,3-cd)pyrene	193-39-5	330	µg/kg	10	µg/L

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PROJECT LIST OF ANALYTES
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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Semivolatile Organic Compounds (continued)	EPA 3550B	EPA 3510C	EPA 8270C ³		Isophorone	78-59-1	330	µg/kg	10	µg/L
					m,p-Cresol	106-44-5	660	µg/kg	20	µg/L
					Naphthalene	91-20-3	330	µg/kg	10	µg/L
					Nitrobenzene	98-95-3	330	µg/kg	10	µg/L
					N-nitrosodi-n-propylamine	621-64-7	330	µg/kg	10	µg/L
					N-nitrosodiphenylamine	86-30-6	330	µg/kg	10	µg/L
					o-Cresol	95-48-7	330	µg/kg	10	µg/L
					Octachlorostyrene	29082-74-4	330	µg/kg	10	µg/L
					p-Chloroaniline (4-Chloroaniline)	106-47-8	330	µg/kg	10	µg/L
					p-Chlorobenzenethiol	106-54-7	330	µg/kg	10	µg/L
					Pentachlorobenzene	608-93-5	330	µg/kg	10	µg/L
					Pentachlorophenol	87-86-5	1600	µg/kg	50	µg/L
					Phenanthrene	85-01-8	330	µg/kg	10	µg/L
					Phenol	108-95-2	330	µg/kg	10	µg/L
					Phthalic acid	88-99-3	330	µg/kg	10	µg/L
					Pyrene	129-00-0	330	µg/kg	10	µg/L
					Pyridine	110-86-1	660	µg/kg	20	µg/L
					Thiophenol	108-98-5	330	µg/kg	10	µg/L
					Tentatively Identified Compounds (TICs)		NA	µg/kg	NA	µg/L
Volatile Organic Compounds	EPA 5030B/ EPA 5035	EPA 5030B	EPA 8260B		1,1,1,2-Tetrachloroethane	630-20-6	5	µg/kg	1	µg/L
					1,1,1-Trichloroethane	71-55-6	5	µg/kg	1	µg/L
					1,1,2,2-Tetrachloroethane	79-34-5	5	µg/kg	1	µg/L
					1,1,2-Trichloroethane	79-00-5	5	µg/kg	1	µg/L
					1,1-Dichloroethane	75-34-3	5	µg/kg	1	µg/L
					1,1-Dichloroethene	75-35-4	5	µg/kg	1	µg/L
					1,1-Dichloropropene	563-58-6	5	µg/kg	1	µg/L
					1,2,3-Trichlorobenzene	87-61-6	5	µg/kg	1	µg/L
					1,2,3-Trichloropropane	96-18-4	5	µg/kg	1	µg/L
					1,2,4-Trichlorobenzene	120-82-1	5	µg/kg	1	µg/L
					1,2,4-Trimethylbenzene	95-63-6	5	µg/kg	1	µg/L
					1,2-Dichlorobenzene	95-50-1	5	µg/kg	1	µg/L
					1,2-Dichloroethane	107-06-2	5	µg/kg	1	µg/L
					1,2-Dichloroethene	540-59-0	10	µg/kg	2	µg/L
					1,2-Dichloropropane	78-87-5	5	µg/kg	1	µg/L
					1,3,5-Trichlorobenzene	108-70-3	5	µg/kg	5	µg/L
					1,3,5-Trimethylbenzene	108-67-8	5	µg/kg	1	µg/L
					1,3-Dichlorobenzene	541-73-1	5	µg/kg	1	µg/L
					1,3-Dichloropropene	542-75-6	5	µg/kg	1	µg/L

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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Volatile Organic Compounds (continued)	EPA 5030B/ EPA 5035	EPA 5030B	EPA 8260B		1,3-Dichloropropane	142-28-9	5	µg/kg	1	µg/L
					1,4-Dichlorobenzene	106-46-7	5	µg/kg	1	µg/L
					2,2-Dichloropropane	594-20-7	5	µg/kg	1	µg/L
					2,2-Dimethylpentane	590-35-2	5	µg/kg	1	µg/L
					2,2,3-Trimethylbutane	464-06-2	5	µg/kg	1	µg/L
					2,3-Dimethylpentane	565-59-3	5	µg/kg	1	µg/L
					2,4-Dimethylpentane	108-08-7	5	µg/kg	1	µg/L
					2-Chlorotoluene	95-49-8	5	µg/kg	1	µg/L
					2-Hexanone	591-78-6	20	µg/kg	5	µg/L
					2-Methylhexane	591-76-4	5	µg/kg	1	µg/L
					2-Nitropropane	79-46-9	10	µg/kg	10	µg/L
					3,3-Dimethylpentane	562-49-2	5	µg/kg	1	µg/L
					3-Ethylpentane	617-78-7	10	µg/kg	10	µg/L
					3-Methylhexane	589-34-4	5	µg/kg	10	µg/L
					4-Chlorobenzene	108-90-7	5	µg/kg	1	µg/L
					4-Chlorotoluene	106-43-4	5	µg/kg	1	µg/L
					4-Methyl-2-pentanone (MIBK)	108-10-1	10	µg/kg	5	µg/L
					Acetone	67-64-1	20	µg/kg	2	µg/L
					Acetonitrile	75-05-8	50	µg/kg	10	µg/L
					Benzene	71-43-2	5	µg/kg	1	µg/L
					Bromobenzene	108-86-1	5	µg/kg	1	µg/L
					Bromodichloromethane	75-27-4	5	µg/kg	1	µg/L
					Bromoform	75-25-2	5	µg/kg	1	µg/L
					Bromomethane	74-83-9	10	µg/kg	2	µg/L
					Carbon disulfide	75-15-0	5	µg/kg	1	µg/L
					Carbon tetrachloride	56-23-5	5	µg/kg	1	µg/L
					Chlorobenzene	108-90-7	5	µg/kg	1	µg/L
					Chlorobromomethane	74-97-5	5	µg/kg	1	µg/L
					Chlorodibromomethane	124-48-1	5	µg/kg	1	µg/L
					Chloroethane	75-00-3	5	µg/kg	2	µg/L
					Chloroform	67-66-3	5	µg/kg	1	µg/L
					Chloromethane	74-87-3	10	µg/kg	2	µg/L
					cis-1,2-Dichloroethene	156-59-2	5	µg/kg	1	µg/L
					cis-1,3-Dichloropropene	10061-01-5	5	µg/kg	1	µg/L
					Cymene (Isopropyltoluene)	99-87-6	10	µg/kg	1	µg/L
					Dibromochloroethane	73506-94-2	5	µg/kg	1	µg/L
					Dibromochloromethane	124-48-1	5	µg/kg	1	µg/L
					Dibromochloropropane	96-12-8	10	µg/kg	1	µg/L

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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Volatile Organic Compounds (continued)	EPA 5030B/ EPA 5035	EPA 5030B	EPA 8260B		Dibromomethane	74-95-3	5	µg/kg	1	µg/L
					Dichloromethane (Methylene chloride)	75-09-2	5	µg/kg	1	µg/L
					Dimethyldisulfide	624-92-0	5	µg/kg	5	µg/L
					Ethanol	64-17-5	200	µg/kg	250	µg/L
					Ethylbenzene	100-41-4	5	µg/kg	1	µg/L
					Freon-11 (Trichlorofluoromethane)	75-69-4	5	µg/kg	1	µg/L
					Freon-113 (1,1,2-Trifluoro-1,2,2-trichloroethane)	76-13-1	5	µg/kg	1	µg/L
					Freon-12 (Dichlorodifluoromethane)	75-71-8	10	µg/kg	2	µg/L
					Heptane	142-82-5	5	µg/kg	1	µg/L
					Isoheptane (same as 2-Methylhaxane)	31394-54-4	TBD	µg/kg	TBD	µg/L
					Isopropylbenzene	98-82-8	5	µg/kg	1	µg/L
					m,p-Xylene	mp-XYL	5	µg/kg	2	µg/L
					Methyl ethyl ketone (2-Butanone)	78-93-3	20	µg/kg	5	µg/L
					Methyl iodide	74-88-4	5	µg/kg	2	µg/L
					MTBE (Methyl tert-butyl ether)	1634-04-4	5	µg/kg	2	µg/L
					n-Butyl benzene	104-51-8	5	µg/kg	1	µg/L
					n-Propylbenzene	103-65-1	5	µg/kg	1	µg/L
					Nonanal	124-19-6	10	µg/kg	5	µg/L
					o-Xylene	95-47-6	5	µg/kg	1	µg/L
					sec-Butylbenzene	135-98-8	5	µg/kg	1	µg/L
					Styrene	100-42-5	5	µg/kg	1	µg/L
					tert-Butyl benzene	98-06-6	5	µg/kg	1	µg/L
					Tetrachloroethene	127-18-4	5	µg/kg	1	µg/L
					Toluene	108-88-3	5	µg/kg	1	µg/L
					trans-1,2-Dichloroethene	156-60-5	5	µg/kg	1	µg/L
					trans-1,3-Dichloropropene	10061-02-6	5	µg/kg	1	µg/L
					Trichloroethene	79-01-6	5	µg/kg	1	µg/L
					Vinyl acetate	108-05-4	5	µg/kg	2	µg/L
					Vinyl chloride	75-01-4	5	µg/kg	2	µg/L
					Xylenes (total)	1330-20-7	10	µg/kg	3	µg/L
					Tentatively Identified Compounds (TICs)		NA	µg/kg	NA	µg/L
Water Quality Parameters	NA	EPA 120.1	NA	EPA 120.1	Conductivity	COND	NA	mg/kg	10	µohms/cm
		EPA 130.2		EPA 130.2	Hardness, total	Hardness	NA	mg/kg	5	mg/L
		EPA 160.1		EPA 160.1	Total dissolved solids	TDS	NA	mg/kg	5	mg/L
		EPA 160.2		EPA 160.2	Total suspended solids	TSS	NA	mg/kg	5	mg/L
		EPA 310.1		EPA 310.1	Alkalinity, Total (as CaCO ₃)	ALK	NA	mg/kg	5	mg/L
		Bicarbonate alkalinity			71-52-3	NA	mg/kg	5	mg/L	
		Carbonate alkalinity			3812-32-6	NA	mg/kg	5	mg/L	
		Hydroxide alkalinity			OH-ALK	NA	mg/kg	5	mg/L	

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Parameter of Interest	Preparation Method		Analytical Method		Compound List	CAS Number	Laboratory Limits			
	Soil	Water	Soil	Water			Soil		Water	
Flashpoint	NA		NA	EPA 1010	Flammables	NA	TBD	mg/kg	TBD	mg/L
Total Petroleum Hydrocarbons	EPA 3550	EPA 3510	EPA 8015M	EPA 8015M	Diesel	64742-46-7	25	mg/kg	0.5	mg/L
					Mineral Spirits	NA	25	mg/kg	0.5	mg/L
	EPA 3550	EPA 3510	EPA 8015B	EPA 8015B	Gasoline	8006-61-9	25	mg/kg	0.5	mg/L
	EPA 1664A	EPA 1664A	EPA 1664A	EPA 1664A	Oil/Grease	68153-81-1	25	mg/kg	0.5	mg/L
White Phosphorus	EPA 7580M		EPA 7580M		White phosphorus	12185-10-3	TBD	mg/kg	TBD	mg/L
Methyl Mercury	EPA 1630		EPA 1630		Methyl mercury	22967-92-6	TBD	mg/kg	TBD	mg/L

Notes:

Reporting Limits - Based on laboratory limits for primary laboratory (TestAmerica).

Laboratory limits are subject to matrix interferences and may not always be achieved in all samples.

TBD = To be determined by the laboratory prior to sample analysis and submitted for approval.

The laboratory will be instructed to report the top 25 Tentatively Identified Compounds (TICs) under method 8260B and 8270C.

* = Activities for specific radionuclide will be back-quantitated from those analyzed.

NA = Not applicable.

¹For polynuclear aromatic hydrocarbons, Method 8270C is the primary analytical method, but Method 8310 may be used if necessary.

²TestAmerica-Richland, WA method.

³Method 3540 for extraction and Method 3640 for cleanup are to be used as appropriate.