

EDEN NORTH CAROLINA COAL ASH SPILL SOIL RESULTS

NOTE: The data below represents soil samples that were collected on June 30, 2014 by EPA START Team 1. These samples were collected in the same locations as previous sediment samples. At the time these samples were collected, the water level was lower and these locations are now considered soil samples. Soil sample measurements are in milligrams per kilogram (mg/kg). The data is being compared to ecological risk screening levels (ERSLs) to protect aquatic life in the sediments of the Dan River as well as human health screening standards. Specific qualifiers and footnotes are listed below the summary table. These samples were collected at various locations along the river (refer to map for generalized locations). The detected concentrations in sediment are all below the ERSLs with the exception of aluminum, barium, iron, and manganese. There were no exceedances of human health screening criteria for sediment. When chemical concentrations exceed the screening values it doesn't mean there will be adverse health or ecological effects, but recommends further investigation may be needed.

Analyte	Human Health Screening Standards for Sediment ¹		Ecological Screening Standards for Sediment ²		Town Creek - 1	
Sample Information						
Sample ID	-	-	-	-	EDEN-TC-1-0006-SD-20140630	
Date	-	-	-	-	06/30/2014	
Time	-	-	-	-	1057	
Status	-	-	-	-	Validation Complete	
Type	-	-	-	-	Soil	
Total Metals						
Aluminum	273,000 max	mg/kg	3,200 (bkg)	mg/kg	19000	mg/kg
Antimony	110	mg/kg	2 ^a	mg/kg	1.6UJ	mg/kg
Arsenic	120	mg/kg	9.8	mg/kg	3.3	mg/kg
Barium	54,600	mg/kg	60 ^b	mg/kg	170	mg/kg
Beryllium	547	mg/kg	-	-	1	mg/kg
Boron	54,700	mg/kg	-	-	16U	mg/kg
Cadmium	246 ^c	mg/kg	0.99	mg/kg	0.13	mg/kg
Calcium	Essential nutrient		-	-	2100	mg/kg
Chromium	104 ^f	mg/kg	43.4	mg/kg	35	mg/kg
Cobalt	82.1	mg/kg	50	mg/kg	13	mg/kg
Copper	11,000	mg/kg	31.6	mg/kg	21	mg/kg
Iron	192,000 max	mg/kg	6,800 (bkg)	mg/kg	29000	mg/kg
Lead	400	mg/kg	35.8	mg/kg	13	mg/kg
Magnesium	Essential nutrient		-	-	4200	mg/kg
Manganese	6,560	mg/kg	460 ^c	mg/kg	810	mg/kg
Mercury	27.4 ^g	mg/kg	0.18	mg/kg	0.041	mg/kg
Molybdenum	1,370	mg/kg	-	-	0.61J	mg/kg
Nickel	132	mg/kg	22.7	mg/kg	15	mg/kg
Potassium	Essential nutrient		-	-	3200J	mg/kg
Selenium	1,370	mg/kg	2 ^d	mg/kg	0.74J	mg/kg
Silver	1,370	mg/kg	0.733	mg/kg	0.16U	mg/kg
Sodium	Essential nutrient		-	-	320U	mg/kg
Thallium	2.74 ^h	mg/kg	-	mg/kg	0.31	mg/kg
Vanadium	1,380	mg/kg	57 ^c	mg/kg	53J	mg/kg
Zinc	82,100	mg/kg	121	mg/kg	64J	mg/kg
Physical Properties						
Percent Ash	-	-	-	-	-	-

Notes

¹ Values are based on ELCR=10-4 or HI = 1. Assumptions: EF=100 days/year. ET=2 hr/event

² MacDonald, D.D.; Ingersoll, C.G.; Smorong, D.E.; Lindskoog, R.A.; Sloane, G; and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Florida Department of Environmental Protection, Tallahassee, FL. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters.

^a The screening value for antimony is from Long, Edward R., and Lee G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52.

^b The screening value for barium was the probable effect level (PEL) instead of the threshold effect level (TEL) because the TEL was below background

^c Sediment screening values for manganese and vanadium come from the NOAA SQUIRT. <http://response.restoration.noaa.gov/sites/default/files/SQUIRTs.pdf>

^d The screening value for selenium is from Region 3 after Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. US Forest Service, Blacksburg, VA.

^e Cadmium from diet

^f Chromium (VI)

^g Methyl Mercury

^h Thallium Chloride

% Percent

EPA U.S. Environmental Protection Agency

J Value is estimated

mg/kg milligrams per kilogram

ND No fly ash detected at a PLM reporting limit of 1 percent

PLM Polarized light microscopy

U Analyte was not detected at the listed reporting limit.

UJ Analyte was not detected at the listed reporting limit, which is an estimated quantitation.

EDEN NORTH CAROLINA COAL ASH SPILL SOIL RESULTS

Analyte	Human Health Screening Standards for Sediment ¹		Ecological Screening Standards for Sediment ²		Town Creek - 2		Town Creek - 3	
Sample Information								
Sample ID	-	-	-	-	EDEN-TC-2-0006-SD-20140630	EDEN-TC-3-0006-SD-20140630		
Date	-	-	-	-	06/30/2014	06/30/2014		
Time	-	-	-	-	1112	1120		
Status	-	-	-	-	Validation Complete	Validation Complete		
Type	-	-	-	-	Soil	Soil		
Total Metals								
Aluminum	273,000 max	mg/kg	3,200 (bkg)	mg/kg	20000	mg/kg	17000	mg/kg
Antimony	110	mg/kg	2 ^a	mg/kg	1.6UJ	mg/kg	1.4UJ	mg/kg
Arsenic	120	mg/kg	9.8	mg/kg	3.3	mg/kg	4	mg/kg
Barium	54,600	mg/kg	60 ^b	mg/kg	160	mg/kg	140	mg/kg
Beryllium	547	mg/kg	-	-	1.1	mg/kg	1	mg/kg
Boron	54,700	mg/kg	-	-	16U	mg/kg	14U	mg/kg
Cadmium	246 ^c	mg/kg	0.99	mg/kg	0.12	mg/kg	0.11	mg/kg
Calcium	Essential nutrient		-	-	1600	mg/kg	1400	mg/kg
Chromium	104 ^f	mg/kg	43.4	mg/kg	37	mg/kg	32	mg/kg
Cobalt	82.1	mg/kg	50	mg/kg	13	mg/kg	11	mg/kg
Copper	11,000	mg/kg	31.6	mg/kg	21	mg/kg	19	mg/kg
Iron	192,000 max	mg/kg	6,800 (bkg)	mg/kg	29000	mg/kg	25000	mg/kg
Lead	400	mg/kg	35.8	mg/kg	14	mg/kg	14	mg/kg
Magnesium	Essential nutrient		-	-	4000	mg/kg	3500	mg/kg
Manganese	6,560	mg/kg	460 ^c	mg/kg	630	mg/kg	570	mg/kg
Mercury	27.4 ^g	mg/kg	0.18	mg/kg	0.039	mg/kg	0.041	mg/kg
Molybdenum	1,370	mg/kg	-	-	0.61J	mg/kg	0.53J	mg/kg
Nickel	132	mg/kg	22.7	mg/kg	15	mg/kg	13	mg/kg
Potassium	Essential nutrient		-	-	3100J	mg/kg	2600J	mg/kg
Selenium	1,370	mg/kg	2 ^d	mg/kg	0.75J	mg/kg	0.7	mg/kg
Silver	1,370	mg/kg	0.733	mg/kg	0.16U	mg/kg	0.14U	mg/kg
Sodium	Essential nutrient		-	-	320U	mg/kg	270U	mg/kg
Thallium	2.74 ^h	mg/kg	-	mg/kg	0.31	mg/kg	0.28	mg/kg
Vanadium	1,380	mg/kg	57 ^c	mg/kg	55J	mg/kg	48J	mg/kg
Zinc	82,100	mg/kg	121	mg/kg	63J	mg/kg	56J	mg/kg
Physical Properties								
Percent Ash	-	-	-	-	-	-	-	-

Notes

¹ Values are based on ELCR=10-4 or HI = 1. Assumptions: EF=100 days/year. ET=2 hr/event

² MacDonald, D.D.; Ingersoll, C.G.; Smorong, D.E.; Lindskoog, R.A.; Sloane, G; and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Florida Department of Environmental Protection, Tallahassee, FL. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters.

^a The screening value for antimony is from Long, Edward R., and Lee G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52.

^b The screening value for barium was the probable effect level (PEL) instead of the threshold effect level (TEL) because the TEL was below background

^c Sediment screening values for manganese and vanadium come from the NOAA SQuIRT. <http://response.restoration.noaa.gov/sites/default/files/SQuIRTS.pdf>

^d The screening value for selenium is from Region 3 after Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. US Forest Service, Blacksburg, VA.

^e Cadmium from diet

^f Chromium (VI)

^g Methyl Mercury

^h Thallium Chloride

% Percent

EPA U.S. Environmental Protection Agency

J Value is estimated

mg/kg milligrams per kilogram

ND No fly ash detected at a PLM reporting limit of 1 percent

PLM Polarized light microscopy

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EDEN NORTH CAROLINA COAL ASH SPILL SOIL RESULTS

Analyte	Human Health Screening Standards for Sediment ¹		Ecological Screening Standards for Sediment ²		Town Creek - 4		Town Creek - 5		Town Creek - 5	
Sample Information										
Sample ID	-		-		EDEN-TC-4-0006-SD-20140630		EDEN-TC-5-0006-SD-20140630		EDEN-TC-5-0006-SD-20140630-DUP	
Date	-		-		06/30/2014		06/30/2014		06/30/2014	
Time	-		-		1132		1145		1150	
Status	-		-		Validation Complete		Validation Complete		Validation Complete	
Type	-		-		Soil		Soil		Soil	
Total Metals										
Aluminum	273,000 max	mg/kg	3,200 (bkg)	mg/kg	17000	mg/kg	13000	mg/kg	13000	mg/kg
Antimony	110	mg/kg	2 ^a	mg/kg	1.5UJ	mg/kg	1.3UJ	mg/kg	1.4UJ	mg/kg
Arsenic	120	mg/kg	9.8	mg/kg	3	mg/kg	2.7	mg/kg	2.6J	mg/kg
Barium	54,600	mg/kg	60 ^b	mg/kg	150	mg/kg	120	mg/kg	120	mg/kg
Beryllium	547	mg/kg	-	-	0.98	mg/kg	0.75	mg/kg	0.75	mg/kg
Boron	54,700	mg/kg	-	-	15U	mg/kg	13U	mg/kg	14U	mg/kg
Cadmium	246 ^c	mg/kg	0.99	mg/kg	0.14	mg/kg	0.079	mg/kg	0.077	mg/kg
Calcium	Essential nutrient		-	-	1600	mg/kg	1200	mg/kg	1100	mg/kg
Chromium	104 ^f	mg/kg	43.4	mg/kg	33	mg/kg	26	mg/kg	27	mg/kg
Cobalt	82.1	mg/kg	50	mg/kg	12	mg/kg	9.9	mg/kg	9.9	mg/kg
Copper	11,000	mg/kg	31.6	mg/kg	19	mg/kg	14	mg/kg	14	mg/kg
Iron	192,000 max	mg/kg	6,800 (bkg)	mg/kg	27000	mg/kg	20000	mg/kg	21000	mg/kg
Lead	400	mg/kg	35.8	mg/kg	13	mg/kg	9.4	mg/kg	9	mg/kg
Magnesium	Essential nutrient		-	-	3800	mg/kg	3400	mg/kg	3400	mg/kg
Manganese	6,560	mg/kg	460 ^c	mg/kg	640	mg/kg	460	mg/kg	440	mg/kg
Mercury	27.4 ^g	mg/kg	0.18	mg/kg	0.036	mg/kg	0.027	mg/kg	0.025J	mg/kg
Molybdenum	1,370	mg/kg	-	-	0.56J	mg/kg	1.3U	mg/kg	0.42J	mg/kg
Nickel	132	mg/kg	22.7	mg/kg	14	mg/kg	11	mg/kg	11	mg/kg
Potassium	Essential nutrient		-	-	2900J	mg/kg	2600J	mg/kg	2700J	mg/kg
Selenium	1,370	mg/kg	2 ^d	mg/kg	0.72J	mg/kg	0.5J	mg/kg	0.43J	mg/kg
Silver	1,370	mg/kg	0.733	mg/kg	0.15U	mg/kg	0.13U	mg/kg	0.14U	mg/kg
Sodium	Essential nutrient		-	-	300U	mg/kg	270U	mg/kg	270U	mg/kg
Thallium	2.74 ^h	mg/kg	-	mg/kg	0.32	mg/kg	0.24	mg/kg	0.24	mg/kg
Vanadium	1,380	mg/kg	57 ^c	mg/kg	49J	mg/kg	37J	mg/kg	38J	mg/kg
Zinc	82,100	mg/kg	121	mg/kg	59J	mg/kg	47J	mg/kg	47J	mg/kg
Physical Properties										
Percent Ash	-	-	-	-	-	-	-	-	-	-

Notes

¹ Values are based on ELCR=10⁻⁴ or HI = 1. Assumptions: EF=100 days/year. ET=2 hr/event

² MacDonald, D.D.; Ingersoll, C.G.; Smorong, D.E.; Lindskoog, R.A.; Sloane, G; and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Florida Department of Environmental Protection, Tallahassee, FL. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters.

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% Percent

EPA U.S. Environmental Protection Agency

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EDEN NORTH CAROLINA COAL ASH SPILL SOIL RESULTS

Analyte	Human Health Screening Standards for Sediment ¹		Ecological Screening Standards for Sediment ²		Town Creek - 6	
Sample Information						
Sample ID	-		-		EDEN-TC-6-0006-SD-20140630	
Date	-		-		06/30/2014	
Time	-		-		1153	
Status	-		-		Validation Complete	
Type	-		-		Soil	
Total Metals						
Aluminum	273,000 max	mg/kg	3,200 (bkg)	mg/kg	17000	mg/kg
Antimony	110	mg/kg	2 ^a	mg/kg	1.5UJ	mg/kg
Arsenic	120	mg/kg	9.8	mg/kg	5	mg/kg
Barium	54,600	mg/kg	60 ^b	mg/kg	150	mg/kg
Beryllium	547	mg/kg	-	-	1.1	mg/kg
Boron	54,700	mg/kg	-	-	15U	mg/kg
Cadmium	246 ^c	mg/kg	0.99	mg/kg	0.19	mg/kg
Calcium	Essential nutrient		-	-	1400	mg/kg
Chromium	104 ^f	mg/kg	43.4	mg/kg	33	mg/kg
Cobalt	82.1	mg/kg	50	mg/kg	12	mg/kg
Copper	11,000	mg/kg	31.6	mg/kg	19	mg/kg
Iron	192,000 max	mg/kg	6,800 (bkg)	mg/kg	26000	mg/kg
Lead	400	mg/kg	35.8	mg/kg	13	mg/kg
Magnesium	Essential nutrient		-	-	3600	mg/kg
Manganese	6,560	mg/kg	460 ^c	mg/kg	510	mg/kg
Mercury	27.4 ^g	mg/kg	0.18	mg/kg	0.038	mg/kg
Molybdenum	1,370	mg/kg	-	-	0.63J	mg/kg
Nickel	132	mg/kg	22.7	mg/kg	13	mg/kg
Potassium	Essential nutrient		-	-	2600J	mg/kg
Selenium	1,370	mg/kg	2 ^d	mg/kg	0.68J	mg/kg
Silver	1,370	mg/kg	0.733	mg/kg	0.15U	mg/kg
Sodium	Essential nutrient		-	-	300U	mg/kg
Thallium	2.74 ^h	mg/kg	-	mg/kg	0.33	mg/kg
Vanadium	1,380	mg/kg	57 ^c	mg/kg	50J	mg/kg
Zinc	82,100	mg/kg	121	mg/kg	59J	mg/kg
Physical Properties						
Percent Ash	-	-	-	-	-	-

Notes

¹ Values are based on ELCR=10⁻⁴ or HI = 1. Assumptions: EF=100 days/year. ET=2 hr/event

² MacDonald, D.D.; Ingersoll, C.G.; Smorong, D.E.; Lindskoog, R.A.; Sloane, G; and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Florida Department of Environmental Protection, Tallahassee, FL. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters.

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^c Sediment screening values for manganese and vanadium come from the NOAA SQuIRT. <http://response.restoration.noaa.gov/sites/default/files/SQuIRTS.pdf>

^d The screening value for selenium is from Region 3 after Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. US Forest Service, Blacksburg, VA.

^e Cadmium from diet

^f Chromium (VI)

^g Methyl Mercury

^h Thallium Chloride

% Percent

EPA U.S. Environmental Protection Agency

J Value is estimated

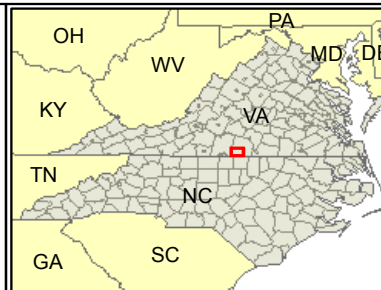
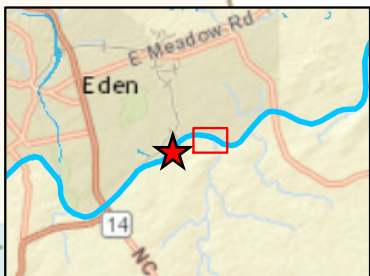
mg/kg milligrams per kilogram

ND No fly ash detected at a PLM reporting limit of 1 percent

PLM Polarized light microscopy

U Analyte was not detected at the listed reporting limit.

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Legend

- Approximate Spill Location
- Soil Sample Location

Imagery Source:
ESRI, USGS Mapping Service, 2013



130 65 0 130 Feet

Eden Coal Ash Spill
Eden, North Carolina

Soil
Sample Locations
June 30, 2014

