

Supplementary Information

Effect of bicarbonate and phosphate on arsenic release from mining-impacted sediments in the Cheyenne River watershed, South Dakota, USA

Cherie L. DeVore,^a Lucia Rodriguez-Freire,^b Abdul Mehdi-Ali,^c Carlyle Ducheneaux,^d Kateryna Artyushkova,^e Melissa Gonzales^f, Johnnye Lewis,^g Zhe Zhou,^h Drew E. Latta,^h ,Virgil W. Lueth and José M. Cerrato^{a*}

^aDepartment of Civil Engineering, MSC01 1070, University of New Mexico, Albuquerque, New Mexico 87131, USA. E-mail: jcerrato@unm.edu; Fax: (001) (505) 277-1918; Telephone: (001) (505) 277-0870

^bDepartment of Civil and Environmental Engineering, 266 Colton Hall, University Heights, New Jersey Institute of Technology, Newark, New Jersey 07102

^cDepartment of Earth and Planetary Sciences, MSC03 2040, University of New Mexico, Albuquerque, New Mexico 87131, USA

^dDepartment of Environmental and Natural Resources, Cheyenne River Sioux Tribe, Eagle Butte, South Dakota 57625

^eDepartment of Chemical and Biological Engineering and Center for Microengineered Materials, University of New Mexico, Albuquerque, New Mexico 87131, USA

^fSchool of Medicine, Department of Internal Medicine, University of New Mexico Health Sciences Center, MSC10 5550, Albuquerque NM 87131

^gCommunity Environmental Health Program, College of Pharmacy, MSC09 5360, 1 University of New Mexico, Albuquerque, USA

^h Department of Civil and Environmental Engineering/IIHR, The University of Iowa, 4105 Seamans Center, Iowa City, Iowa 52242, USA

ⁱNew Mexico Bureau of Geology, New Mexico Tech, Socorro, New Mexico

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^aDepartment of Civil Engineering, MSC01 1070, University of New Mexico, Albuquerque, New Mexico 87131, USA. E-mail: jcerrato@unm.edu; Fax: (001) (505) 277-1918; Telephone: (001) (505) 277-0870

Table S1. Additional Water quality data from Cheyenne River Watershed

Site ID	Site name	River	Date	Lat	Long	As (ug L ⁻¹)	Pb (ug L ⁻¹)	U (ug L ⁻¹)	Fe (ug L ⁻¹)	Mn (ug L ⁻¹)
CC-CR	Cherry Creek	Cheyenne River	6/6/2016	44.598319	-101.498875	5.84	17.56	15.84	-	-
DR-CR	Deal Ranch	Cheyenne River	6/6/2016	44.579775	-101.706836	5.14	13.11	13.56	-	-
RL-MR	Ross Lawrence	Moreau River	6/7/2016	45.238323	-101.970637	1.47	13.40	14.42	-	-
TB-MR	Thunder Butte	Moreau River	6/7/2016	45.220150	-101.653280	2.05	15.67	18.43	-	-
WW	Whitewood Creek	Whitewood Creek	9/28/2016	44.371930	-103.281480	62.16	12.82	5.14	2010	81.3
BF	Belle Fourche	Belle Fourche	9/28/2016	44.401376	-103.291026	18.98	9.94	17.63	3046	93.8
BF/WW	Belle Fourche/Whitewood	Belle Fourche	9/28/2016	44.380840	-103.253050	2.25	7.46	15.76	3081	82.8
WA	Wasta	Cheyenne River	9/28/2016	44.044790	-102.235880	6.68	17.76	15.15	10861	220
BR	Bridger	Cheyenne River	9/28/2016	44.321070	-101.543920	6.10	6.37	6.25	29.0	6.18

Table S2. HPLC/ICP-MS Conditions

HPLC Conditions	
As Species	As(V), As(III)
Mobile Phase	146 mg/L Ethylenediaminetetraacetic acid (EDTA) + 0.650 mL Tetrabutylammonium hydroxide (TBAoH) + 5% HPLC grade methanol (MeOH) in 1L MilliQ
Flow Rate	1 mL/min
pH	7 (±0.01)
Pressure	1000-1600 psi
Column	A CAPCELL PAK C18 column (250 mm × 4.6 mm, 5 µm particle size)
Column Temperature	50 degrees C
Injection volume	10 µL

Table S3. pKa values of arsenate, arsenite and phosphoric acid

	Pk ₁	Pk ₂	Pk ₃
Arsenate (H₃AsO₄)	2.19	6.94	11.5
Arsenite (H₃AsO₃)	9.2	14.22	19.22
Phosphoric Acid (H₃PO₄)	2.15	7.20	12.35

Figure S1. pH measurements during experiments with mine waste solids **A)** Whitewood Creek (WW) and **B)** Deal Ranch (DR) reacted with 0.2 mM sodium bicarbonate, 20 mM sodium bicarbonate and deionized water (DI control)

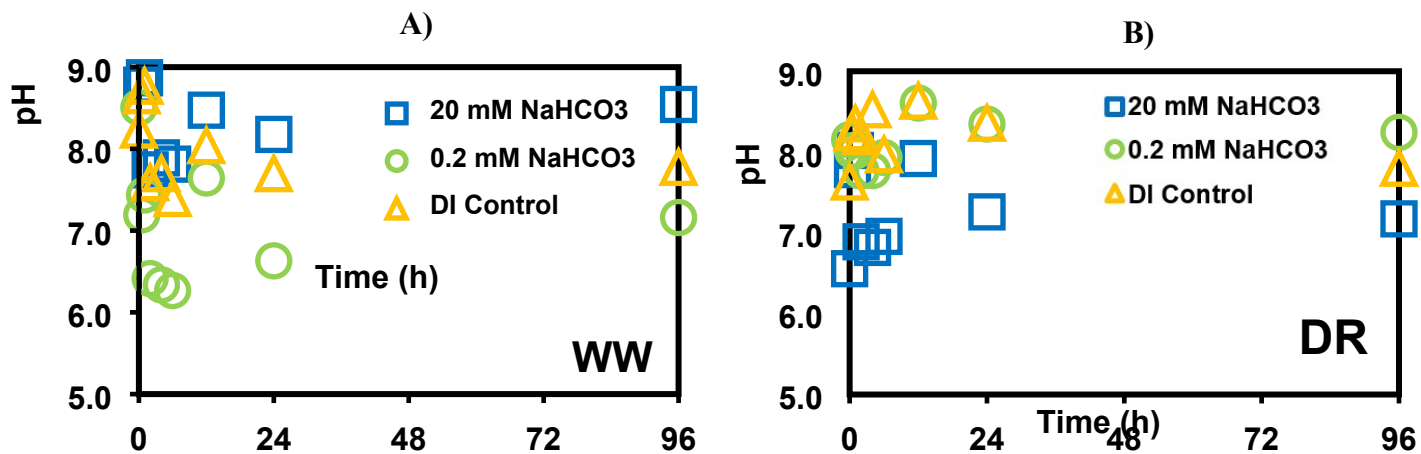


Figure S2. pH measurements during experiments with mine waste solids **A)** Whitewood Creek (WW) and **B)** Deal Ranch (DR) reacted with 0.1 mM sodium phosphate, 10 mM sodium phosphate and deionized water (DI control)

