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Supplemental Material

Occurrence of Lead and Other Toxic Metals Derived from Drinking-Water Systems in Three West African Countries

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Table S1. Positive predictive value (PPV), negative predictive value (NPV), and percent agreement between test and retest WHO GV exceedance results for TMs in test-retest comparisons of water samples from the same water systems (N=109).

	Antimony	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium
PPV*	0%	0%	0%	0%	N/A	17%	33%	14%	N/A	0%	0%
NPV**	100%	100%	100%	99%	100%	96%	95%	99%	100%	100%	100%
% Agreement***	85%	99%	85%	97%	100%	92%	90%	94%	100%	97%	99%

*PPV (Positive predictive value) is defined here as the proportion of sources exceeding the applicable WHO GV in the initial test that also exceeded the WHO GV in the re-test.**NPV (Negative predictive value) is defined here as the proportion of sources not exceeding (i.e. conforming to) the applicable WHO GV in the initial test that also did not exceed the WHO GV in the re-test.

***Agreement is defined here as the proportion of sources that either a) exceeded the applicable WHO GV at both test and retest, or else b) did not exceed (i.e. that conformed to) the applicable WHO GV at both test and at retest.

The results presented in this table indicate that even where NPV and % Agreement is high, PPV is relatively low for TMs of interest.

Table S2. Mean, median, and maximum relative mass fraction of 13 metals from water system component scrapings (N=61 systems).

	Antimony	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Tin	Zinc
Arithmetic Mean	0.21%	0.30%	0.00%	7.63%	9.65%	35.28%	6.35%	2.84%	0.00%	12.86%	0.00%	1.48%	23.38%
Median	0.01%	0.02%	0.00%	2.39%	0.73%	35.12%	0.12%	0.73%	0.00%	6.02%	0.00%	0.05%	4.49%
Maximum	7.12%	12.46%	0.05%	46.57%	74.96%	97.32%	74.37%	78.58%	0.05%	73.61%	0.04%	35.58%	99.40%

The results presented in this table indicate that component scrapings from some components and systems contained substantive mass fractions of lead as a TM of public health concern.

Table S3. Multivariable linear regressions for associations between concentrations of TM of interest and other measured metals (controlling for country, pH, conductivity, and stagnation time).

	Antimony	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Tin	Zinc
Antimony		0.002	0.515	0.048*	7.2E-4	3.2E-5*	-0.003	-3.7E-4	0.377	-0.006	0.0150	-0.015***	-1.3E-4
Arsenic	2.088		-3.822	-0.314	0.005	-1.2E-4	0.046	2.4E-4	-3.178	-0.032	-0.144	0.093	5.6E-4
Cadmium	0.014	-8.9E-5		-0.018***	8.0E-4***	-2.99E-6	0.002	2.2E-4**	0.036	0.003	0.003	-5.7E-4	1.4E-5
Chromium	0.623*	-0.003	-8.270***		0.013***	7.3E-5	0.220***	0.002	1.060	0.008	0.023	0.020*	-4.2E-4
Copper	4.102	0.024	161.556***	5.731***		-0.003*	3.157***	-0.081*	-7.478	2.628***	-0.338	0.124	-0.008
Iron	678.785*	-2.153	-2277.594	120.454	-10.109*		47.051	9.852***	-411.828	59.160	30.153	-20.829	3.540***
Lead	-0.292	0.004	6.344	1.889***	0.062***	2.5E-4		0.002	-2.673	-0.153	-0.053	-0.034	0.002**
Manganese	-9.064	0.005	186.202**	2.846	-0.342*	0.011***	0.368		-21.310	1.291	-0.998	0.420	0.002
Mercury	0.023	-1.6E-4	0.079	0.005	-8.1E-5	-1.2E-6	-0.001	-5.5E-5		7.4E-4	7.1E-4	5.4E-4	1.1E-5
Nickel	-0.422	-0.002	6.585	0.043	0.310***	1.9E-4	-0.092	0.004	0.797		-0.001	0.003	-1.6E-4
Selenium	0.951	-0.008	5.71	0.110	-0.004	8.9E-5	-0.030	-0.003	0.728	-0.001		0.077***	-1.5E-4
Tin	-11.035***	0.061	-16.217	1.247*	0.017	-7.8E-4	-0.242	0.014	6.952	0.040	0.976***		0.003
Zinc	-112.447	0.448	479.987	-31.294	-1.389	0.161***	17.040**	0.093	169.954	-2.328	-2.338	3.139	

Note: *p<0.05; **p<0.01; ***p<0.001

The results presented in this table indicate strong associations between several TMs of interest and other TMs and/or “indicator” metals such as copper, iron, tin, and zinc. Of particular interest, lead concentration was strongly associated with chromium, copper, and zinc.

Table S4. Normalized multivariable linear regression for associations between concentrations of lead and other measured metals (controlling for country, pH, conductivity, and stagnation time).

	Antimony	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Tin	Zinc
Lead	-0.292	0.004	6.344	1.889***	0.062***	2.5E-4		0.002	-2.673	-0.153	-0.053	-0.034	0.002**
Normalized effect (coeff./median conc.)	0.0292	0.001	0.317	0.945	0.682	0.013		0.014	-0.134	-0.153	-0.025	-0.013	0.011

Note: *p<0.05; **p<0.01; ***p<0.001

The results presented in this table indicate that lead concentration was associated with concentrations of chromium, copper, and zinc.

Table S5. Multivariable regression of log lead occurrence controlling for log lead groundwater occurrence and controlling for other relevant covariates (pH, conductivity, water system type, water system age, stagnation time, and country).

		Adjusted Estimate (Standard Error)
N		104
R²		0.27
Country	Ghana	REF
	Mali	0.36 (0.32)
Water System Type	Handpump	REF
	Public Tap	1.31** (0.41)
Age of Water System		0.016 (0.016)
Stagnation Time		7.5E ⁻⁴ (0.002)
pH		-0.380 (0.221)
Conductivity		3.5E ⁻⁴ (4.5E-4)
Log Lead in Groundwater		0.694*** (0.163)

Note: *p<0.05; **p<0.01; ***p<0.001

The results presented in this table indicate that lead concentration in water samples was associated with water system type and log lead concentration in fully-flushed groundwater samples in the multivariable regression results shown. Estimate is adjusted for age of water system,

Table S6. Comparison of Ghana and Mali Samples to UNC Reanalysis of Duplicate Aliquots

A) Relative Percent Deviation

Country	Sample ID	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Tin	Uranium	Iron	Calcium	Magnesium	Potassium	Sodium
Ghana	7961805	74747%	689%	-79400%	-871%	-32%	-1230%	-4341%	-21717%	98%	4294%	43%	741337%	8692%	-21%	-683%	-355%	-1325%	81%
Ghana	7961808	-129%	-1916%	5519%	-130%	324%	-9435%	-832%	-62906%	89%	-8117%	-4358%	-231739%	-28%	-253333%	-143%	93%	55%	-2529%
Ghana	7961826	5421%	-883%	4836%	-802%	170%	523%	-899%	1379%	100%	-4032%	23%	17081%	140%	-165%	-46%	68%	69%	-3062%
Ghana	7961847	202377%	-172%	-170237%	-3203%	-8237%	-11514%	-2099%	-15219%	99%	-3709%	-2266%	1566222%	3968%	-6347%	16%	26%	-122%	27%
Ghana	8189518	3120%	-115%	2840%	-6532%	98%	-117%	-366%	-26896%	100%	-32402%	53%	865%	-244063%	80%	-295%	-1465%	-91%	-15614%
Ghana	8189534	-1513%	-1028%	2988%	1147%	188%	175%	87%	3930%	100%	85666%	100%	-10570%	-867%	87%	79%	50%	75%	-988%
Ghana	8189620	13881%	490%	-482%	-850%	-4450%	235%	93%	-6978%	-139%	34265%	-259%	30312%	50959%	-916%	-372%	-10%	69%	79%
Ghana	8189634	142363%	329%	-53546%	-2658%	59%	119%	-47%	-27821%	100%	32253%	79%	198877%	-8667%	5%	-2548%	-3057%	-3769%	-11111%
Ghana	8189637	47157%	-1028%	-23188%	-7182%	63%	-59%	-351%	-21394%	99%	-216245%	11%	71888%	6651%	-6915%	-1489%	-3144%	-1021%	-1216%
Ghana	8189640	12350%	-2661%	-28052%	-1006%	-1337%	1574%	-113%	-8028%	100%	194310%	67%	393624%	5313%	15%	56%	43%	56%	-220%
Ghana	8189645	9626%	2563%	-614%	-791%	-16705%	-406%	-36%	-11833%	100%	-11529%	-533%	-65435%	271%	-6403%	-7%	71%	-187%	81%
Ghana	8189752	1125%	201%	111%	-4264%	36%	97%	-89%	-25287%	96%	11768%	-374%	2569%	138%	-636%	14%	69%	50%	68%
Ghana	8189758	96%	294%	254%	-3223%	107%	379%	-1083%	-9728%	-837%	10246%	84%	5148%	106%	-483%	19%	79%	-346%	96%
Ghana	8189759	1004%	321%	-19023%	-5893%	802%	2974%	-546%	-6292%	-3291%	-127903%	-2329%	63789%	237%	-3427%	-232%	88%	48%	-159%
Ghana	8189763	268874%	225%	-319951%	-6858%	-4863%	-5894%	16%	-17333%	-4638%	40727%	-1546%	993992%	57875%	84%	63%	72%	-2022%	92%
Ghana	8189768	7452%	-398%	-6149%	1048%	108%	160%	114%	48583%	100%	32737%	104%	237480%	4428%	113%	98%	97%	94%	55%
Ghana	8189778	9450%	517%	-53897%	-1763%	-1035%	-285%	-472%	-24031%	99%	116075%	-121%	199009%	2709%	89%	52%	6%	47%	58%
Ghana	8189785	-10432%	635%	48368%	-2959%	-27%	69%	95%	-14398%	95%	-15093%	-33%	-35000%	73%	-49%	75%	92%	-35%	87%
Ghana	8189786	60833%	1835%	-11058%	-402%	-120%	78%	84%	-3864%	100%	-80108%	73%	49936%	-7895%	99%	-62%	-918%	-127%	-5165%
Ghana	8189794	82516%	7738%	-19701%	-5407%	45%	70%	92%	19627%	100%	16401%	66%	303924%	1996%	-316%	-26%	-5%	-12%	-7%
Ghana	8189797	11452%	4831%	348%	-1346%	-29%	-3483%	75%	-42408%	100%	-	-54%	13778%	5175%	-236%	-1334%	-1060%	-8%	-471%
Ghana	8189852	7252%	-1286%	-5314%	-456%	-1554%	1290%	96%	-11871%	100%	-18211%	-7839%	183592%	6680%	-64288%	23%	55%	32%	-12%
Ghana	8189853	49035%	164%	-511428%	-2968%	-15650%	-1116%	-5399%	-47876%	99%	160886%	-6597%	423200%	29443%	96%	24%	58%	-1363%	82%
Ghana	8189854	-1873%	-1157%	150236%	-1448%	-12092%	-721531%	-2439%	-36682%	99%	10841%	-7572%	-313663%	77%	-17479%	47%	91%	57%	35%
Ghana	8189857	82273%	148%	-48997%	-1350%	-88448%	-686%	-1007%	-4664%	94%	-17789%	-401%	999952%	911%	83%	95%	82%	79%	100%
Ghana	8189865	1563%	972%	164837%	-193%	3471%	-11299%	95%	-13534%	-3389%	-2213%	-573%	-120120%	202%	-466%	-27%	90%	-34%	-620%
Ghana	8189883	4968%	-410%	-66396%	-794%	-34481%	-28792%	-284%	1563%	97%	2392%	-44472%	-275051%	140%	-1641%	31%	78%	8%	88%
Ghana	8189900	34337%	1563%	26529%	-582%	-1779%	3171%	25%	-48746%	98%	1378%	-64%	-43708%	5294%	-10372%	-20%	30%	63%	-38%
Ghana	8189912	16461%	-2816%	-1146%	-633%	84%	175%	-733%	-11129%	100%	-333%	91%	10648%	10335%	-7402%	-316%	-106%	1%	-46%
Ghana	8189921	131585%	1244%	-10843%	-6%	535%	5014%	235%	15862%	100%	3412%	25%	1008785%	1722%	-1399%	28%	29%	84%	8%

Ghana	8189951	556118%	6033%	-341533%	-18406%	-1830%	2029%	-852%	1757%	100%	-	-58%	1839219%	7148%	100%	59%	82%	95%	88%
Ghana	8189957	1013779%	-4960%	-	108%	1790%	1633%	-371%	36236%	100%	546%	91%	1380001%	3066%	115%	-1626%	-2443%	-461%	-1051%
Ghana	8189964	23889%	13105%	-4513%	-19455%	98%	-18%	33%	-13500%	100%	-119550%	63%	26580%	1278%	-316%	-	-4988%	-6229%	-4969%
Ghana	8189966	48812%	1833%	-34674%	-2716%	92%	97%	45%	-38702%	100%	181819%	90%	118345%	616%	-873%	-883%	-1281%	74%	-4456%
Ghana	8189970	1213%	-552%	-712%	-506%	99%	89%	97%	-465429%	100%	17038%	99%	881%	300%	-1426%	-2103%	-4893%	-2193%	-3434%
Ghana	8191543	15139%	663%	-11185%	-3409%	92%	95%	-1388%	-206904%	100%	-108384%	75%	1725%	700%	-323%	78%	74%	97%	-766%
Ghana	8191552	36605%	925%	-8729%	-7048%	79%	99%	-1313%	-15047%	100%	-249538%	44%	49551%	1945%	-299%	-765%	-1263%	88%	-5773%
Ghana	8995989	94936%	308%	-3326%	-3263%	-4827%	-765%	44%	-5734%	99%	72229%	-570%	170445%	23990%	80%	84%	87%	71%	97%
Ghana	8995990	115545%	194%	-345805%	-3545%	-5441%	1%	-556%	-4252%	-180%	-6326%	-113%	234336%	8162%	-398%	-85%	-838%	-482%	92%
Ghana	9129588	-14897%	583%	10572%	-187%	230%	-342%	-39829%	-60435%	100%	-27612%	-95%	-78749%	93%	53%	14%	61%	15%	-461%
Ghana	9129592	3468%	465%	77707%	-7335%	-69686%	-1694%	-3438%	-23198%	98%	2528%	-136%	-156901%	104%	-2848%	54%	70%	-65%	85%
Ghana	9129600	78476%	165%	-135636%	1875%	3642%	248%	-629%	-2801376%	100%	1658%	-193%	2751092%	15540%	-5565%	-168%	-237%	-1998%	-368%
Ghana	9129800	211465%	142%	-	-1373%	-1048%	-69%	-31323%	-15166%	100%	-616908%	-58%	261411%	1596%	27%	-1294%	-830%	-660%	-827%
Ghana	9129814	21584%	355%	-54760%	-1699%	-41%	-35%	-723%	-19430%	100%	-97%	-2838%	171114%	106%	-4381%	-183%	45%	-1527%	77%
Ghana	9129820	96596%	131%	-84091%	-5420%	-1790%	-4811%	93%	-17782%	100%	18759%	-366%	1313193%	430%	-1555%	35%	43%	-120%	19%
Ghana	9129832	12337%	277%	-104018%	-3346%	90%	100%	-83%	-10702%	98%	-5167%	89%	49004%	176%	-286%	92%	91%	72%	65%
Mali	7964625	-77%	50%	9%	63%	-24%	-105%	3%	-2114%	100%	-1%	-20%	-22553%	-	-57%	-12%	-20%	-62%	-31%
Mali	7964716	-81%	83%	-1044%	-48%	-39%	-192%	-7%	-	100%	-1745%	-27%	-391%	-	-699%	-9%	-19%	-28%	-28%
Mali	7964736	97%	87%	-190%	-14%	-12%	-52%	-150%	-16201%	100%	-2972%	2%	-31%	-	-62%	-189%	-29%	-114%	-38%
Mali	8189671	-6%	91%	-12%	84%	-17%	-26%	75%	-	100%	-47739%	-2%	-15%	-	-22%	-954%	79%	-32%	-36%
Mali	8189744	-132%	-24%	-77%	46%	-338%	-257%	-1037%	-975%	100%	-	-49%	-284%	-	-166%	-322%	-133%	-178%	-125%
Mali	8995831	8%	53%	1%	-44%	-10%	-36%	-226%	-1416%	100%	-5435%	4%	-233%	-	-292%	-574%	-11%	-26%	-153%
Mali	9129642	-29%	80%	-1660%	61%	-74%	-67%	-222%	-4094%	100%	-2470%	-63%	-8571%	-	5%	-131%	-54%	-49%	-51%
Mali	9129670	-38%	73%	-13%	-102%	-26%	-61%	-3960%	-264410%	100%	-2079%	-9%	-372%	-	-620%	-2045%	-57%	-72%	-8%
Mali	9129752	-29%	75%	-165%	17%	-36%	-214%	99%	-26418%	100%	-6095%	6%	-107%	-	-387%	-134%	-11%	-26%	-32%
Mali	9129763	37%	57%	-611%	-43%	-28%	-508%	97%	-1531%	100%	-27560%	29%	-757%	-	-1405%	-29%	-19%	-19%	-11%
Mali	9129768	88%	62%	-1836%	51%	-50%	-405%	-332%	-12607%	100%	-40703%	-9%	-225%	-	-86%	-8%	-22%	-32%	-30%
Mali	9129786	69%	33%	-66%	73%	-24%	-15%	-197%	-5517%	100%	-23058%	7%	-75%	-	-48%	-27%	-20%	-15%	-8%

B) Absolute Difference (mg/L)

Country	Sample ID	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Tin	Uranium	Iron	Calcium	Magnesium	Potassium	Sodium
Ghana	7961805	0.021702	0.011802	0.003563	0.006322	0.007788	0.00501	0.039323	0.001076	0.38428	0.007299	0.02977	0.062442	0.001923	0.004401	14.42737	4.09794	7.168975	29.43738
Ghana	7961808	3.74E-05	0.002796	0.000201	0.003135	0.000888	0.005014	0.034909	0.00072	0.043323	0.008487	1.192216	0.00692	1.88E-05	8.402572	19.10888	8.764228	1.093357	446.9163
Ghana	7961826	0.000811	0.007165	0.000176	0.007736	0.003252	0.00124	0.025503	0.000101	2.106655	0.016827	0.005905	0.004517	0.000742	0.095398	8.70192	4.439531	1.880736	342.9006
Ghana	7961847	0.023154	0.001085	0.003935	0.009715	0.024902	0.004981	0.002158	0.000299	0.391589	0.003681	0.070923	0.072312	0.002795	0.066688	1.406089	0.639148	6.941451	0.925589
Ghana	8189518	0.001723	0.000918	0.000628	0.012026	0.00696	0.000456	0.002172	0.000837	0.520647	0.006406	0.074295	0.0009	0.040757	0.015804	23.45565	24.09425	2.014708	375.3557
Ghana	8189534	0.000589	0.009518	0.001254	0.002879	0.016638	0.001062	0.008386	0.00011	0.761426	0.012608	0.052656	0.010133	0.000191	0.037448	5.560295	0.821548	1.630408	24.21131
Ghana	8189620	0.005389	0.003034	0.000241	0.002207	0.162586	0.0017	0.194955	0.000282	1.872954	0.008262	0.012654	0.014163	0.004354	0.030934	5.422992	0.149341	5.27802	9.516945
Ghana	8189634	0.020095	0.001904	0.003074	0.009045	0.067123	0.002925	0.004528	0.000285	1.309047	0.015719	0.146609	0.072443	0.002433	0.000758	24.96792	21.73641	2.645933	147.2625
Ghana	8189637	0.020178	0.004931	0.004667	0.020399	0.028866	0.001224	0.027596	0.001288	1.042744	0.007607	0.008475	0.062747	0.00142	0.403978	33.42768	20.4108	3.010659	24.84182
Ghana	8189640	0.000686	0.008427	0.000832	0.00918	0.006339	0.001172	0.000972	0.00045	0.774856	0.014003	0.046089	0.005017	0.000334	0.00724	3.367284	1.055798	0.836185	26.06741
Ghana	8189645	0.001291	0.003555	3.71E-05	0.009203	0.027514	5.25E-05	0.003184	0.000453	1.001405	0.014015	0.019428	0.001324	1.86E-05	0.039626	0.724402	4.832135	1.825494	12.30204
Ghana	8189752	0.001672	0.002385	4.44E-05	0.009279	0.004444	0.053665	0.007681	0.000712	0.186389	0.004864	0.642522	0.000397	0.000341	0.070572	2.67334	5.447281	3.512679	6.05414
Ghana	8189758	4.42E-05	0.006894	2.96E-05	0.006049	0.010275	0.002152	0.007002	0.000284	0.000418	0.001705	0.01436	0.003494	0.004856	0.008672	2.510028	9.637785	4.917256	80.53415
Ghana	8189759	0.000523	0.007902	0.000686	0.010224	0.001745	0.000995	0.007147	0.000362	0.001645	0.007827	0.036745	0.003628	0.000301	0.351837	17.04906	3.903413	0.680298	213.933
Ghana	8189763	0.0231	0.012113	0.004118	0.006775	0.004605	0.001552	0.000294	0.000523	0.002319	0.002932	0.017101	0.066657	0.002428	0.184703	12.0279	4.76862	12.3165	29.39451
Ghana	8189768	0.02152	0.004354	0.002479	0.002721	0.075187	0.005083	0.01205	0.000992	0.964719	0.006998	0.095724	0.065777	0.002973	0.014578	12.1628	4.537888	1.904838	21.18369
Ghana	8189778	0.020419	0.004745	0.004275	0.00948	0.102884	0.030157	0.063115	0.00076	2.516451	0.016866	0.188093	0.061464	0.00259	0.241588	3.070777	0.05594	0.32084	3.68629
Ghana	8189785	0.004952	0.009153	0.002126	0.005065	0.000845	0.001291	0.216905	0.000662	0.077461	0.004488	0.008369	0.02961	0.000965	0.014983	26.65498	23.96894	0.70634	20.13227
Ghana	8189786	0.021109	0.00938	0.002491	0.009777	0.013932	0.005045	0.00141	0.000635	3.954295	0.018389	0.096753	0.055315	0.019343	2.790579	1.433766	17.40218	1.430891	313.8403
Ghana	8189794	0.020674	0.014369	0.003003	0.008887	0.014699	0.00134	0.016204	0.000204	0.675194	0.012454	0.037822	0.076368	0.002372	0.007079	0.634729	0.041525	0.213809	0.084082
Ghana	8189797	0.003422	0.006109	0.00029	0.002357	0.002635	0.048894	0.004046	0.000891	1.242884	-	0.055532	0.003851	0.003874	0.014296	21.48074	7.922951	0.591072	7.940167
Ghana	8189852	0.000894	0.004259	0.000343	0.010754	0.001215	0.000633	0.184917	0.000457	0.874424	0.009303	0.197075	0.002754	0.000404	0.828469	2.158056	3.34251	0.847705	1.364747
Ghana	8189853	0.021665	0.006716	0.003851	0.00833	0.080515	0.008367	0.032386	0.00127	0.404581	0.01062	0.515079	0.065195	0.002173	0.540717	3.962889	5.461718	7.036152	23.38645
Ghana	8189854	0.000354	0.008537	0.001448	0.007385	0.010897	0.011545	0.035362	0.000444	0.43152	0.001404	0.183831	0.004692	0.000243	0.838867	8.419754	12.82612	1.425929	4.722131
Ghana	8189857	0.019819	0.002965	0.002949	0.006686	0.091786	0.002415	0.002106	0.000595	0.08351	0.003208	0.13106	0.059079	0.002577	0.201146	16.51708	1.475269	0.417484	250.3248
Ghana	8189865	0.000313	0.007183	0.000855	0.001758	0.0011	0.001364	0.063183	0.00071	0.001694	0.005205	0.011946	0.00191	0.000252	0.006212	3.959842	5.330813	0.4024	146.8219
Ghana	8189883	0.001125	0.003807	0.000699	0.010112	0.02796	0.008945	0.029834	5.15E-05	0.935932	0.001133	2.318048	0.001716	0.000552	0.487786	7.050658	9.119467	0.312781	21.18485
Ghana	8189900	0.002224	0.006902	0.000376	0.00194	0.002555	0.00104	0.005495	0.001584	0.330876	0.002313	0.001591	0.002379	0.003689	0.155522	1.128387	0.761825	4.031893	0.664515
Ghana	8189912	0.005561	0.009748	0.000577	0.00355	0.036796	0.002841	0.013296	0.000389	1.300988	1.76E-05	0.059852	0.011971	0.004424	0.12875	5.331896	0.913688	0.014474	0.858426
Ghana	8189921	0.022261	0.011163	0.002909	0.000155	0.005264	0.001664	0.00104	0.001466	3.564422	0.000633	0.004936	0.069723	0.003157	0.518963	2.984955	1.151381	9.622831	1.150836

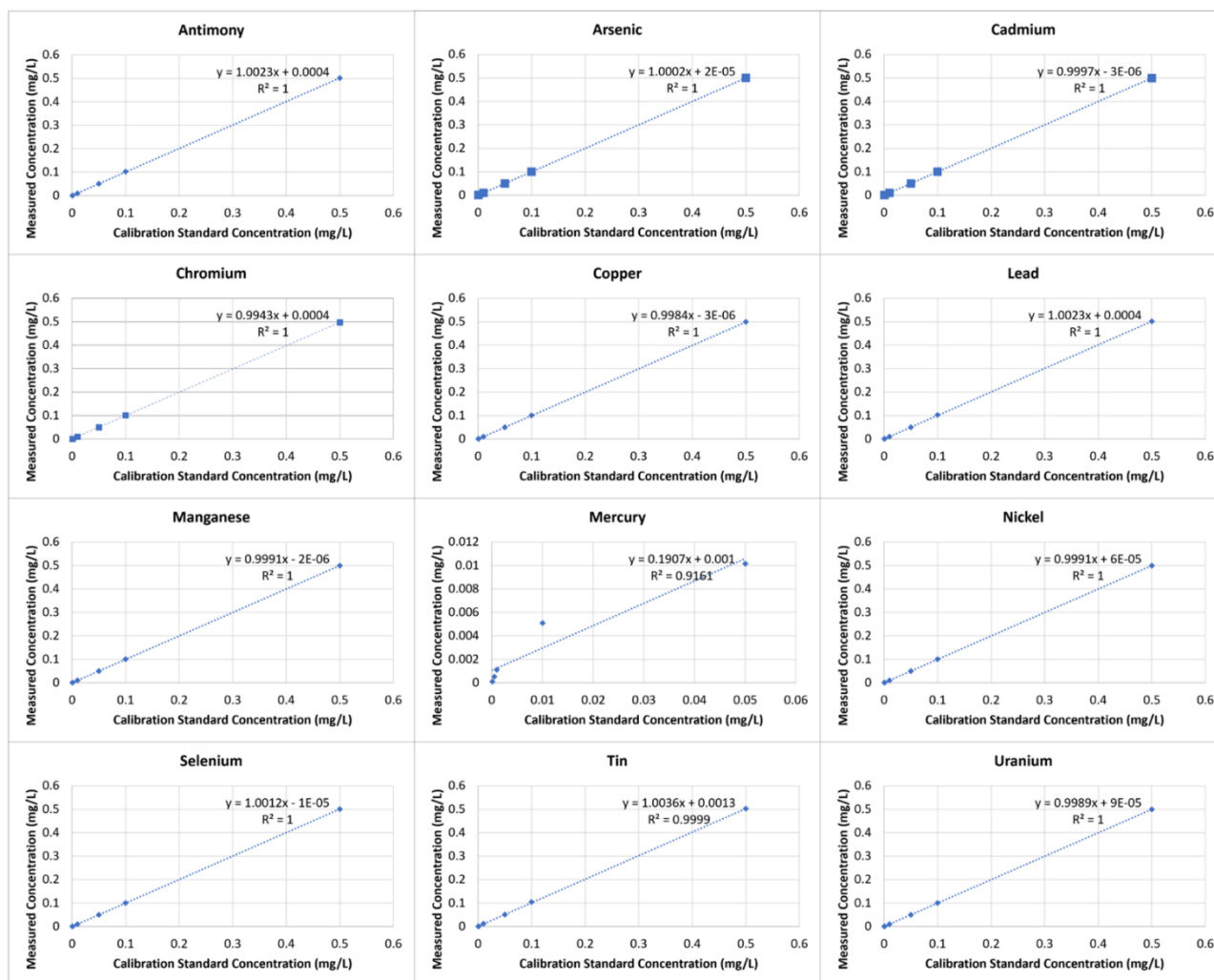
Ghana	8189951	0.019174	0.009357	0.002641	0.006712	0.00479	0.001205	0.01117	3.59E-05	0.877035	-	0.004139	0.067905	0.00205	2.104828	1.851194	2.116334	7.839843	13.2154
Ghana	8189957	0.021408	0.008206	-	0.000585	0.003722	0.002018	0.006632	0.000893	1.304183	3.39E-05	0.004843	0.065886	0.002994	0.011924	16.17843	10.14579	1.823509	17.15433
Ghana	8189964	0.018572	0.010147	0.001858	0.005623	0.078004	0.000413	0.008712	0.000465	2.096887	0.004319	0.108682	0.053989	0.001233	0.037591	57.44283	11.73999	2.360229	42.43042
Ghana	8189966	0.019351	0.004526	0.004331	0.013065	0.01105	0.002436	0.186675	0.001502	1.492682	0.00716	0.147289	0.0577	0.00175	0.122469	43.52949	21.50643	3.794024	124.1422
Ghana	8189970	0.001319	0.000957	0.000284	0.0015	0.072882	0.003269	0.008445	0.001026	3.327216	0.001645	0.200943	0.003643	0.000161	0.034268	32.30414	20.56207	2.592846	26.09219
Ghana	8191543	0.019871	0.001173	0.002891	0.012771	0.07886	0.005424	0.011365	0.002191	1.866204	0.00801	0.060255	0.063266	0.002011	0.039664	2.448358	0.747179	5.34864	25.94681
Ghana	8191552	0.019992	0.00202	0.003776	0.015074	0.014379	0.004983	0.224443	0.000417	1.637999	0.01548	0.02933	0.058672	0.001486	0.079201	33.54388	16.27901	7.435906	100.086
Ghana	8995989	0.021904	0.016104	0.003653	0.008599	0.074877	0.003924	0.003694	0.000299	0.42046	0.013604	0.150771	0.064129	0.002345	0.102442	10.5915	3.697084	0.380776	25.90763
Ghana	8995990	0.023366	0.001571	0.003114	0.00714	0.022942	3.37E-05	0.032044	0.000297	0.004651	0.001108	0.016382	0.069299	0.002122	0.017707	7.031686	4.320914	6.414059	77.22001
Ghana	9129588	0.000886	0.009421	0.001254	0.001996	0.000495	0.003761	0.17128	0.001171	0.977317	0.020743	0.012452	0.00757	0.005517	0.158566	5.45859	6.850178	0.155758	140.7558
Ghana	9129592	0.000723	0.004421	0.001571	0.010442	0.056865	0.000648	0.012171	0.000752	0.166919	0.010834	0.01384	0.00201	0.001467	0.035815	14.8005	4.709109	1.074401	16.39888
Ghana	9129600	0.017147	0.007974	0.00193	0.006147	0.007233	0.000211	0.032755	0.001922	0.247512	0.006346	0.017228	0.048191	0.001684	0.130881	27.06596	18.35996	3.830012	26.23402
Ghana	9129800	0.020627	0.000819	0.00245	0.016109	0.009476	0.000442	0.053347	0.00057	1.688144	0.024055	0.018115	0.055802	0.002439	0.053134	20.70884	6.286075	3.223393	17.13115
Ghana	9129814	0.021977	0.005783	0.002437	0.011666	0.00237	0.000694	0.001541	0.000797	0.370662	0.008947	0.48142	0.057741	0.037553	0.087726	25.03107	6.145396	33.04975	155.3749
Ghana	9129820	0.018506	0.005741	0.002377	0.007758	0.053891	0.003498	0.028428	0.000559	0.132173	0.00517	0.077003	0.050235	0.002526	0.039156	11.79206	5.365485	2.08381	6.388765
Ghana	9129832	0.022985	0.009612	0.003901	0.008838	0.011819	0.006561	0.000502	0.000391	0.086982	0.00342	0.046678	0.068198	0.005779	0.012476	15.37547	9.213304	1.562774	48.96423
Mali	7964625	2.17E-05	0.000294	6.38E-06	0.00052	0.001752	0.000651	0.002237	0.000117	8.263766	2.77E-08	0.015237	0.003485	-	0.041044	0.411225	0.254826	3.472648	0.353312
Mali	7964716	2.24E-05	0.001457	9.13E-05	0.00117	0.002079	0.001405	0.000353	-	0.732726	0.000946	0.001171	0.000131	-	0.073014	1.997563	2.757189	1.780177	3.652289
Mali	7964736	1.31E-05	0.000589	4.66E-06	0.000434	0.00051	0.000167	0.001476	0.000497	4.607602	0.000197	0.000124	3.75E-06	-	0.075973	6.319556	0.687048	1.487487	0.607091
Mali	8189671	6.72E-06	0.000503	1.36E-05	0.000894	0.01821	0.000988	0.002618	-	2.857304	0.000998	0.00404	4.2E-05	-	0.00309	6.299628	0.110953	0.089531	0.529811
Mali	8189744	1.37E-05	0.000577	1.21E-05	0.000374	0.001026	0.000587	0.010996	2.25E-05	0.888359	-	0.001124	3.79E-05	-	0.030832	11.91438	3.252459	2.561234	7.549627
Mali	8995831	1.71E-05	0.000345	5.19E-08	0.000448	0.002961	0.001666	0.003979	4.75E-05	2.184747	0.000982	0.000532	0.000189	-	0.035259	6.609433	0.261367	0.452352	1.969427
Mali	9129642	6.3E-05	0.001552	1.2E-05	0.0008	0.003799	0.000696	0.034847	0.00013	0.805681	0.000961	0.044222	0.00346	-	0.000818	23.84973	4.316566	0.964573	21.31298
Mali	9129670	5.14E-05	0.000276	1.16E-06	0.001634	0.035099	0.004692	0.022746	0.000606	26.0601	0.000127	0.011562	0.000222	-	0.072851	12.5942	0.196855	0.517447	0.086512
Mali	9129752	6.04E-05	0.001207	3.8E-06	0.000192	0.00732	0.001277	0.224092	0.000517	0.765115	0.000984	0.000871	1.74E-05	-	0.01655	22.96354	1.278228	1.531575	0.661515
Mali	9129763	2.88E-05	0.000402	5.76E-06	0.000328	0.002779	0.003279	0.065051	3.57E-05	0.783287	0.000996	0.001287	0.000225	-	0.11405	0.970346	0.279877	0.695441	0.3658
Mali	9129768	6.2E-05	0.000636	9.48E-05	0.001735	0.004725	0.001136	0.006614	0.000133	3.218401	0.000998	0.002327	4.22E-05	-	0.003091	0.582606	0.471668	0.529759	2.644407
Mali	9129786	9.05E-05	0.000148	3.73E-06	0.000728	0.003209	0.000859	0.015738	6.94E-05	1.434303	0.000996	0.045598	7.87E-05	-	0.006016	0.092398	0.026545	0.074767	0.178277

C) Exceedance Agreement (relative to WHO GV for each TM)

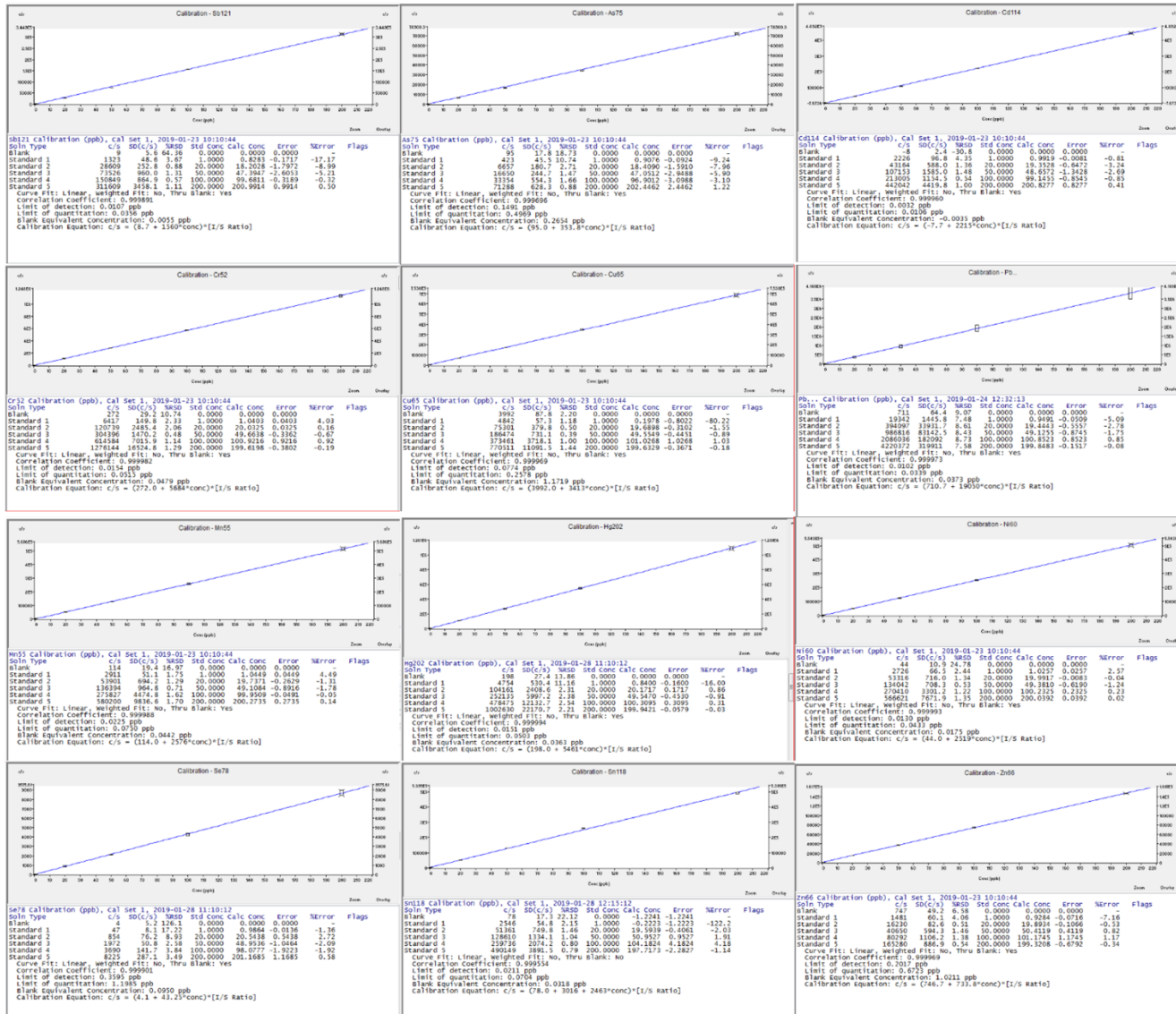
Element	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Tin	Uranium	Iron
Agreement Proportion All (n=58)	100.0%	96.6%	77.2%	100.0%	100.0%	93.1%	98.3%	100.0%	12.1%	100.0%	96.6%	37.9%	95.7%	82.8%
Agreement Proportion Ghana (n=46)	100.0%	95.7%	71.1%	100.0%	100.0%	93.5%	97.8%	100.0%	15.2%	100.0%	95.7%	21.7%	95.7%	78.3%
Agreement Proportion Mali (n=12)	100.0%	100.0%	100.0%	100.0%	100.0%	91.7%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	-	100.0%

The results presented in these tables indicate that while results from Ghana, Niger, and Mali datasets may vary from those obtained when duplicates were analyzed by ICP-MS at UNC, particularly for low concentrations, agreement with respect to WHO GV exceedance was high for most TMs and indicator metals studied.

Figure S1. Indicative Calibration Curves

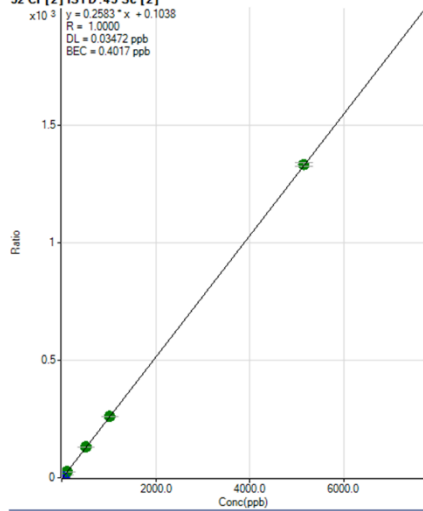


A) Ghana and Niger Samples – Indicative ICP-OES Calibration Curves

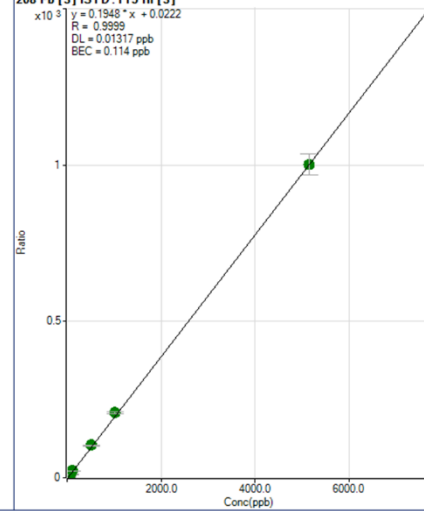


B) Mali – Indicative ICP-MS Calibration Curves

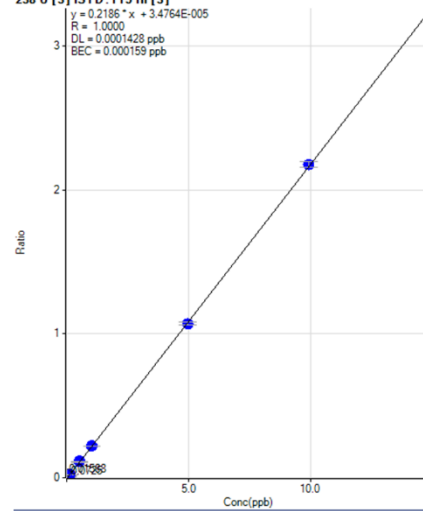
52 Cr [2] ISTD:45 Sc [2]
x10³
 $y = 0.2583 \cdot x + 0.1038$
R = 1.0000
DL = 0.03472 ppb
BEC = 0.4017 ppb



208 Pb [3] ISTD:115 In [3]
x10³
 $y = 0.1948 \cdot x + 0.0222$
R = 0.9999
DL = 0.01317 ppb
BEC = 0.114 ppb



238 U [3] ISTD:115 In [3]
 $y = 0.2186 \cdot x + 3.4764E-005$
R = 1.0000
DL = 0.0001428 ppb
BEC = 0.000159 ppb



C) UNC Samples – Indicative ICP-MS Calibration Curves