



Contaminated? or NOT Contaminated?

or Does Bird Poo Really Affect Sample Validation?

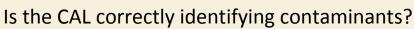


Jane Rothert and Phyllis Ballard Illinois Water Survey, Champaign, IL 217-333-7942 rothert@illinois.edu Is the sample contaminated or is it not? That is the question. This poster looks at artificial samples with known contaminants added and addresses two different issues:

- Is the CAL seeing all of the contaminants that come into the lab and are they correctly identifying them?
- . How do these contaminants actually affect the sample concentration?

Samples of deionized water were sent to the laboratory disguised as real samples. Known contaminants had been placed in some of them (others were left clean) to determine whether the contamination screening process in the laboratory was accurate and uniform across all analysts. At the preliminary report review, the samples were renumbered as QA samples and their chemistry and the lab contamination reviewed. The dirtiest sample was one containing an insect with CI concentration = 2.544 ppm and Ca concentration = 1.506 ppm. The other analyte concentrations were equally high.







Pink highlights Indicate wrong Identification or contamination. Green highlights means everyone ext these right.



One Liter NTN Bottle Study

- 1 L NTN bottles with varying amounts of DI water. The smaller the volume of water, the harder it was to see the contaminants or to be able to tell exactly what the contaminant was.
 25 1-L bottles used with eight
- making the observations independently of one another.
- 56% of the observations were correct.
- 44% were to varying degrees incorrect.

Sample contaminant	Specific contamination	Observations	Observations	Observations	Observations	Observations	Observations	Observations	Observations
plant	clover blossom	plant	plant	plant	plant	plastic	plant	plant	speck
insect	spider leg	insect	insect	tan objects	insect	particles	plant	insect	insect
blank	DI water	dear	clear	clear	clear	dear	clear	clear	speck
plant	dandelion seed	plant	plant	plant	plant	plant	plant	plant	plant
insect	ant antenae and head	dirt	plant/insect	objects	insect	blob	dirt	insect	insect
plant	fiber	hair	fiber	objects	plant	particles	plant	fiber	plant
blank	DI water	dear	clear	clear	clear	dear	clear	clear	clear
b.d.	dried	plant/dirt	plant/insect	plant	plant	specks/dust	dirt/plant	bd	bd
insect	wing	insect	insect	insect	insect	particles	plant	insect	insect
blank	DI water	dust	clear	clear	clear	dear	plant	clear	dear
blank	DI water	dear	clear	dust	clear	clear	clear	clear	dear
combo	plant fiber, insect leg, human eyelashes	hairs	hairs/plant	plant/hair	planthair	eyelashes/ things	animal hair	insect/plant/ hair	combo
b.d.	fresh	dust/blk particles	dirt	specks	specks	specks/ particles	dirt	specks	bd
insect	ants	dirt	plant	insect	insect	insect	insect	insect	insect
blank	DI water	dear	clear	clear	clear	clear	plant	clear	dear
plant	mushroom stem	dear	plant	objects	material	fingemail/ feather	fabric fibers	fiber	plant
insect	wing	clear	insect	insect	insect	plant	insect	plant	insect
dirt	dirt	dirt	dirt	dirt	dirt	specks	dirt	bd	specks
plant	yellow dandelion blossom	plant	plant	plant	plant	floating particles	plant	speck	yellow thing
insect	speck	dear	dirt	insect	insect	black fibers particles	dirt	insect	insect
plant	blue flower	plant	dust	tape	paper	tape-like particles	plant	plant	plant
insect	leg	insect	insect	plant	plant	particles	plant	plant/insect	plant
plant	stem	plant	plant	objects	plant	stick	plant	plant	plant



AIRMoN Sample Study

- AIRMoN 250-mL bottles with different amounts of DI water and contaminants added.
- Artificial field forms were used and the sample sent through the lab as "real" samples.
- The smaller bottles improved the deter mination of what was in the bottle.
- There was 18% error in contamination coding.

Actual Contamination in Bottle	Bottle Contamination Observed
fuzz	CLEAR
CLEAR	CLEAR
CLEAR	CLEAR
piece of wood	1 Large Plant Matter
CLEAR	CLEAR
kleenex	Few Small Pieces of White Paper
CLEAR	CLEAR
plant	1 Large Plant Matter
CLEAR	CLEAR
pine needles	3 Large Plant Matter
sponge	Small Pollen
plant	Few Plant Matter
winged ant	1 Insect
yellow rubber	1 large yellow squareish particle
purple paper	3 purple medium particles
coffee	many medium sized brown particles, small piece of tape
grass	Little grass
plant	2 pieces of leaf, volume greater than 50 mL
insect	1 Insect
animal hair & plant	1 Black Animal Hair, 1 Blade of Grass
CLEAR	CLEAR
paper	Small Piece of Paper
cardboard	Small Piece of Cardboard Paper
tape	1 large plant matter
CLEAR	Clear
seed	1 Large Plant Matter
CLEAR	CLEAR
plant/dirt	MUCH dirt and dust and Plant Matter
animal hair & plant	1 blade of grass, 2 black hairs
insect	Unidentified solid black and brown object. Clear water.
CLEAR	CLEAR
plant	Tiny Plant Matter
lint	Fuzzy white and black material
CLEAR	CLEAR
insect	1 Insect Head
lightning bug antennae	1 Black fiber
dirt	MUCH dirt
bd berries	MUCH Plant Matter
ant	1 Insect
leaf	leaf particles
leaf	1 plant stem
tiny ant	1 Insect
dry leaf	Plant Matter

HEAR	CLEAR
ant wing	Tiny dirt
nsect wing	Tiny Insect
oink flower	CLEAR
id	MUCH Small dirt
CLEAR	CLEAR
od plant	Few Small Plant Matter
plant (tiny bit of leaf)	1 Small Plant Matter
arass	CLEAR
yd .	Little Pollen and dirt
nsect	1 Insect
nair hrush	1 grass blade
white clover blossom	Tiny Plant Matter
CLEAR	CLEAR
cardboard	One piece of brown material, looks like cardboard.
CIFAR	CLEAR
dandelion seed	MUCH Large Plant Matter
pristle brush piece	1 Small Plant Matter
ightning bug leg	1 Large Plant Matter
inv ant	1 Insect
plant/leaf	Little Small Plant Matter
string	CLEAR
non	clear sample
nimal hair	Many Black Animal Hair
red lint	big reddish brown piece of fuzz
nrown leaf	1 leaf, small black specks
200	CLEAR
int	Few Large fiber
100	CLEAR
adv bug	1 Large Insect
carpet fiber	1 Large fiber
200	CLEAR
ree bud	Little Plant Matter
nen	clear sample
nen	CLEAR
nsect leg	Plant Matter
piece of leaf	Plant Matter
nsect wing	Little Plant Matter
nen	CLEAR
olack string	1 Large Black fiber and 1 Black Specks
iny light brown speck, plant?	1 piece of unidentified brown particle
non	CLEAR



How do contaminants affect ion concentration?

AIRMoN 250 mL bottle	ıs	pН	H ueq/L	Cond uS/cm	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	CI mg/L	NO ₃ mg/L	SO ₄ mg/L	NH ₄ mg/L	PO ₄ mg/L
MDL		5.65		0.9	0.009	0.001	0.001	0.001	0.005	0.010	0.010	0.006	0.002
clean no contam	mean std dev	5.57 0.08	2.72 0.48	1.32 0.18	0.000 0.001	0.000	0.001 0.002	0.002 0.001	0.004 0.016	0.000	0.001 0.003	-0.000 0.001	0.000 0.001
DI	n	17	17	17	17	17	17	17	17	17	17	17	17
bird	mean	6.13	1.45	9.2	0.079	0.289	0.031	0.006	0.006	0.000	0.019	1.575	0.231
droppings	std dev	0.61	1.14	10.1	0.100	0.221	0.037	0.003	0.004	0.000	0.014	2.166	0.182
dirt	mean	5.77 0.13	1.80 0.54	1.5 0.2	0.111	0.021	0.024	0.023	0.008	0.066	0.028	0.003	0.021
contam DI	std dev n	0.13	2	2	2	2	2	2	0.008	2	2	2	2
insect/animal	mean	5.66	2.55	2.4	0.118	0.122	0.016	0.120	0.228	0.008	0.091	0.026	0.099
contam DI	std dev n	0.28 14	0.96 14	2.4 14	0.386 14	0.234	0.038 14	0.314 14	0.648 14	0.020 14	0.292 14	0.052 14	0.152 14
insect/animal	mean				0.024	0.043	0.006	0.030	0.116	0.012	-0.017	0.036	0.018
contam FR difference	n	2											
plant	mean	5.57	2.93	2.4	0.100	0.104	0.051	0.013	0.042	0.004	0.049	0.004	0.023
contam	std dev	0.19	1.18	2.3 17	0.258 17	0.192	0.139	0.020	0.074	0.007	0.109	0.007	0.043
DI	n	17	17	17	17	17	17	17	17	17	17	17	17
plant	mean n	3			0.169	0.267	0.059	0.024	0.033	0.003	0.121	-0.000	0.118
FR difference	n												
human	mean	5.62	2.48	1.6	0.070	0.045	0.007	0.021	0.021	0.003	0.013	0.001	0.007
contam	std dev	0.13	0.70 13	0.5 13	0.086	0.127	0.011	0.028	0.038	0.006	0.015	0.001	0.014
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human	mean n	4			0.710	0.036	0.014	0.040	0.064	0.010	0.024	-0.001	0.006
contam FR difference	n	4											
combination	mean	5.89	2.14	2.2	0.230	0.376	0.125	0.218	0.011	0.007	0.044	0.031	0.097
contam DI	std dev n	0.53 3	1.35	1.2	0.320	0.520	0.175 3	0.301 3	0.001	0.009	0.062	0.044	0.127

Amount of Ion Added Per Contaminant

- Potassium, orthophosphate, sodium, sulfate, and chloride were the primary contaminants from insect and animal matter.
- Potassium, sulfate, and orthophosphate were present in samples with plant matter.
- Human and dirt contamination did not show a pattern.

DI H ₂ O		pН	ueqH	Cond	mg Ca	mg K	mg Mg	mg Na	mg Cl	mg NO3	mg SO4	mg NH4	mg PO4
insect	mean	5.60	553.90	1.7	0.552	11.275	0.654	4.243	3.275	0.497	1.392	5.014	19.496
contam	median	5.55	606.05	1.5	0.000	2.694	0.085	1.505	1.880	0.000	0.000	2.244	1.864
	std dev	0.23	188.61	0.5	1.461	14.669	0.952	7.362	2.658	1.315	2.794	8.394	27.553
	n	8		8	8	8	8	8	8	8	8	8	8
plant	mean	5.48	625.27	1.5	0.270	6.208	0.520	0.407	1.187	0.879	1.872	0.000	2.012
contam	median	5.54	573.95	1.4	0.000	6.824	0.464	0.363	1.706	0.000	0.000	0.000	1.947
	std dev	0.15	266.33	0.2	0.662	4.676	0.431	0.098	1.050	1.393	2.334	0.000	1.524
	n	7		7	7	7	7	7	7	7	7	7	7



Real Sample Contamination Code Comparisons

AIRMoN

- 157 out of 625 real samples (25%) have the lab and the field contamination coding in agreement.
- 468 samples (75%) show lab vs. field contamination coding disagreement where contamination is
 present in the field, the lab, or both.
- Of the 468 samples in disagreement, 96 (21%) samples change contamination status based on the lab coding that impacts the Quality Rating of the sample.
- 316 samples with no contamination reported in the field have lab contamination coding with 70
 (22%) of those differences impacting the Quality Rating.
- 26 (4%) samples with "dirt/dust/soot particles" in the field were coded as insect, plant, handling, or other in the lab affecting the Quality Rating of the samples.

NTN

- 1230 W or WD samples with contams in field and/or lab.
- 51 (4%) lab contam codes changed the sample from NON to containing contamination.

Concentrations Contributed by Contaminants

- Insects added appeared to consistently add potassium and chloride.
- Plants added potassium uniformly, but also calcium to some of the samples.
 Dirt contributed calcium as did most of the human-type contamination
- Bird droppings consistently contributed potassium, orthophosphate, and
- . Bird droppings had to be fresh to contribute much in the way of ammonium.

Conclusions

- The CAL is good in general at telling that there is SOMETHING in the sample.
- The CAL is NOT good at determining what that contamination is or was.
- Being specific about what contamination is seen in the bottles is adding inaccurate data that sounds official, but is in reality meaningless.
- Sample Validation is often dependent on inaccurate observations.



