DEPARTMENT OF
Soil Science
UNIVERSITY OF WISCONSIN–MADISON

December 5, 2022

Report to Town of Primrose and Primrose Gun and Conservation Club

Topic: Lead levels in soil within club sporting clay area

On September 19 Geoff Siemering, UW Madison Extension, met with representatives of the Primrose Gun and Conservation Club, town council and club neighbors at the club sporting clay shooting area. After a discussion of lead (Pb) and polycyclic aromatic hydrocarbon (PAH) soil contamination, the group moved to sample the area in question.

Surface samples were analyzed for a range of elements using a portable x-ray fluorescence (XRF) spectrometer by Mr. Siemering. Composite samples of 30 increments each were collected by group members using stainless steel soil probes provided by Mr. Siemering. Each increment was a 1" diameter 4" deep soil plug collected by pushing the steel probe into the ground, twisting and pulling the probe up. The plugs were then deposited into a plastic bucket for further processing.

The composite samples were collected from three regions within the shooting area. Region 1 is beyond the further range that shot is expected to fall and can be considered to give background soil elemental values. Region 2 is from the furthest range that shot can be expected to fall to where shot is estimated to likely fall (per club member estimates). Region 3 is the area where shot is expected to fall most heavily. Surface XRF Pb sample analysis confirmed estimates of shot fall density. One additional composite sample was collected within the area closest to the gun stands for analysis for PAH compounds. A map of the sample locations is attached.

Mr. Siemering brought the four composite sample containers back to the UW Madison campus for further processing and analysis. The samples for lead analysis were air dried, deaggregated with a mortar and pestle, and sieved through a 2mm sieve to isolate the soil fraction of the sample collected. Material smaller than 2mm is considered the soil fraction and this removes all larger rock fragments and plant material. After sieving the composite samples were mixed thoroughly and three subsamples were analyzed using the XRF. The sample for PAH analysis was dried, aggregates broken apart by hand and obvious sporting clay fragments removed. This sample analyzed by CT Laboratories (Baraboo, WI). The data for this analysis appended to the end of this report.

Sample analysis showed that the soil lead background values for the area are approximately 12ppm (mg/kg) (Region 1). Region 2 showed a slight increase to 24ppm. Region 3 soil averaged 198ppm. The region 3 surface sample were generally higher than the composite. This is likely due to dilution from soil with lower lead concentrations from below the surface being mixed with higher Pb surface soil. The variation (79-307ppm) seen in the samples analyzed from Region 3 are typical of that expected with discrete sample analysis as soil is a highly heterogeneous matrix. Composite sampling helps to smooth out the variation and give more

useful scientific data. The data from the discrete and composite samples are provided as a PDF file. No other elemental enrichment was noted beyond that for Pb.

As expected, the area of highest shot fall showed the highest Pb concentration. At approximately 200ppm, per WDNR guidelines, a “spill” would be considered to have occurred (and hence need to be reported), but a cleanup not mandated as would be the case above 400ppm. One item to note is that no visible shot fragments were observed in the sieved soil. As most shot used at the club is larger than 2mm, it is likely that future “shot harvesting” will not reduce this Pb concentration. The elevated soil Pb levels are likely due to oxidation of the Pb materials and dissolution of the shot into the soil. As use continues, it can be expected that the surface Pb concentrations will continue to increase.

As noted during the discussion at the club, Pb tends to remain in the soil where it is deposited with minimal downward movement in the soil column. It is unlikely that lead contamination at the club will impact local well water supplies. Large rain events can move the contaminated soil downslope and off site. Current site management with the area tilled and planted will reduce the potential for soil runoff. Continued vegetative cover is recommended.

If the club ceases operation and the land is sold, potential buyers should be notified of the Pb soil contamination. An environmental restoration of the area would likely involve the removal and off-site disposal of the top several inches of soil from the most impacted areas. Reuse on site is possible of human contact is prevented and work done in accordance with WDNR guidelines and approvals.

The lead present does not constitute a hazard to the plants growing in the field nor the shooters at the end of the field. There is the potential for elevated Pb levels in the soybeans, but confirmation of this would take further study. If only used as a forage area for wild deer there would be no hazard from deer harvested from the area. In management of the contaminated soil, it is most important to limit contact with the soil. This includes field preparation for planting. The field preparation can result in lead contaminated soil being stuck to boots and tractor tires and implements. This can then cause the lead contaminated material to be transported to areas where it is not expected. Working the area when it is sufficiently dry will prevent most of this soil transport.

Geoffrey Siemering, MS


Sporting clay fall area
Testing for PAHs to be conducted
by WI State Lab of Hygiene
Region 3: Primary shot fall area
Lead at surface ~ 300ppm
Composite 4" core sample ~200ppm
Region2: Furthest shot fall area
Lead at surface ~15ppm
Composite 4" core sample ~24ppm
Region1: Background area, no shot
Lead at surface ~9ppm
Composite 4" sore sample ~12ppm

Primrose Gun Club sporting clay fall area soil PAH values.

The polycyclic aromatic hydrocarbon (PAH) soil test results from a single composite soil sample collected from the sporting clay fall area are shown in Table 1. Sporting clays are almost exclusively made from clay, colorant, and coal tar. The coal tar is the source of the PAH compounds.

Five of the tested compounds (Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Dibenz[a,h]anthracene, Indeno[1,2,3-c,d]pyrene) exceed the WDNR direct contact residual contaminant limits (RCL) for soil. For comparison purposes the PAH soil background values determined for the urban core of Milwaukee are also shown.

Based on the Milwaukee study DNR proposed to increase the RCLs by 10x but this change did not make it through the complete rule making process. With the RCLs increased 10X benzo(a)pyrene would still exceed by 2X the allowable limit.

The level of soil contamination is not surprising based on similar investigations by the U.S. Department of Defense. As more sporting clays are dispersed on the ground in this area the contaminant concentration levels will continue to increase. The compounds listed above are generally immobile in the soil and do not pose a threat to groundwater supplies. Surface water supplies may be impacted if soil is washed from the field directly into the nearby stream in a large rain event.

While organic compounds do decompose in soil, the compounds listed above are known to be particularly persistent in soil with residence times of multiple decades.

As with the soil lead found at the club, the primary health risk to human from these PAHs would be if the land use changes and the area is converted to playgrounds, gardens or another activity where high human-soil contact takes place.

Table 1. Soil PAH values.

PAH Compound (carcinogen in **bold**)	Primrose Gun Club, sporting clay fall area (mg/kg)	WNDR direct contact RCL (mg/kg)	Milwaukee Background PAH values (mg/kg)
Acenaphthene	0.076	3590	0.05
Acenaphthylene	0.00397	NA	0.0352
Anthracene	0.159	17900	0.118
Benz[a]anthracene	1.91	1.14	0.599
Benzo[a]pyrene	2.81	0.115	0.68
Benzo[b]fluoranthene	3.4	1.15	0.878
Benzo[e]pyrene	2.00	NA	NA
Benzo[g,h,i]perylene	2.34	NA	0.465
Benzo[k]fluoranthene	1.16	11.5	0.514
Chrysene	1.84	115	0.764
Dibenz[a,h]anthracene	0.388	0.115	0.144
Fluoranthene	1.59	2390	1.358
Fluorene	0.0302	2390	0.0521
Indeno[1,2,3-c,d]pyrene	2.36	1.15	0.422
1-Methylnaphthalene	0.00484	17.6	0.0373
2-Methylnaphthalene	0.00784	239	0.03965
Naphthalene	0.00865	5.52	0.06894
Phenanthrene	0.45	NA	0.558

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ANALYTICAL REPORT

UW MADISON SOIL SCIENCE
GEOFF SIEMERING
1525 OBSERVATORY DRIVE
MADISON, WI 53706

Project Name: PRIMROSE GUN CLUB
Project Phase: PRIMROSE, WI
Contract #: 3089
Project #:
Folder #: 173533
Purchase Order #:

Arrival Temperature: See COC
Report Date: 12/5/2022
Date Received: 11/8/2022
Reprint Date: 12/5/2022

CT LAB Sample#: 1260865 Sample Description: SPORTING CLAY SOIL Sampled: 9/25/2022 11:00

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results										
Solids, Percent	**98.8**	%			1			11/9/2022 14:35	BMM	EPA 8000C
Organic Results										
1-Methylnaphthalene	**4.84**	ug/kg	1.2 *	5.1	1		11/21/2022 09:00	11/30/2022 14:39	JJY	EPA 8270D-SIM
2-Methylnaphthalene	**7.84**	ug/kg	1.0	5.1	1		11/21/2022 09:00	11/30/2022 14:39	JJY	EPA 8270D-SIM
Acenaphthene	**76.0**	ug/kg	1.0	5.1	1		11/21/2022 09:00	11/30/2022 14:39	JJY	EPA 8270D-SIM
Acenaphthylene	**3.97**	ug/kg	1.0 *	5.1	1		11/21/2022 09:00	11/30/2022 14:39	JJY	EPA 8270D-SIM
Anthracene	**159**	ug/kg	1.1	5.1	1		11/21/2022 09:00	11/30/2022 14:39	JJY	EPA 8270D-SIM
Benzo(a)anthracene	**1910**	ug/kg	100	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Benzo(a)pyrene	**2810**	ug/kg	91	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Benzo(b)fluoranthene	**3400**	ug/kg	100	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Benzo(e)pyrene	**2000**	ug/kg	91	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Benzo(g,h,i)perylene	**2340**	ug/kg	120	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Benzo(k)fluoranthene	**1160**	ug/kg	100	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Chrysene	**1840**	ug/kg	100	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Dibenzo(a,h)anthracene	**388**	ug/kg	120 *	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

CT LAB Sample#: 1260865 Sample Description: SPORTING CLAY SOIL Sampled: 9/25/2022 11:00

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Fluoranthene	**1590**	ug/kg	120	510	100		11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Fluorene	**30.2**	ug/kg	0.91	5.1	1		11/21/2022 09:00	11/30/2022 14:39	JJY	EPA 8270D-SIM
Indeno(1,2,3-cd)pyrene	**2360**	ug/kg	120	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Naphthalene	**8.65**	ug/kg	1.0	5.1	1		11/21/2022 09:00	11/30/2022 14:39	JJY	EPA 8270D-SIM
Phenanthrene	**450**	ug/kg	120 *	510	100		11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM
Pyrene	**2050**	ug/kg	91	510	100	Y	11/21/2022 09:00	12/2/2022 15:09	JJY	EPA 8270D-SIM

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

Notes regarding entire Chain of Custody:

Notes: * Indicates a value in between the LOD (limit of detection) and the LOQ (limit of quantitation). All LOD/LOQs are adjusted to reflect dilution and also any differences in the sample weight / volume as compared to standard amounts.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

Submitted by: Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers

Code	Description
B	Analyte detected in the associated Method Blank.
C	Toxicity present in BOD sample.
D	Diluted Out.
E	Safe, No Total Coliform detected.
F	Unsafe, Total Coliform detected, no E. Coli detected.
G	Unsafe, Total Coliform detected and E. Coli detected.
H	Holding time exceeded.
I	Incubator temperature was outside acceptance limits during test period.
J	Estimated value.
L	Significant peaks were detected outside the chromatographic window.
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.
N	Insufficient BOD oxygen depletion.
O	Complete BOD oxygen depletion.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q	Laboratory Control Sample outside acceptance limits.
R	See Narrative at end of report.
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
T	Sample received with improper preservation or temperature.
U	Analyte concentration was below detection limit.
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.
W	Sample amount received was below program minimum.
X	Analyte exceeded calibration range.
Y	Replicate/Duplicate precision outside acceptance limits.
Z	Specified calibration criteria was not met.

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# 115843
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01

Form #FPM3-04 Rev. 09/2020

CHAIN OF CUSTODY

Company: U W Madison Soil Science
Project Contact: Geoff Siemering
Telephone: 608 262 9969
Project Name: Primrose Gun Club
Project #:
Location: Primrose WI
Sampled By: G. Siemering

CT LABORATORIES

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Folder #: 173533
Company: GENERAL MISC
Project: UW MADISON SOIL SERVICE
Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ______

PO #

Report To:
EMAIL: gsiemering@wisc.edu
Company: UW Madison Soil Science
Address: 1525 Observatory drive 263 Soils Hall, Madison WI 53706

Invoice To:*
EMAIL: nepenthe07@gmail.com
Company: Glenn Reynolds
Address: 8468 Cty Hwy A Verona WI 53593

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Soil is already sieved to 2mm. Sample not shipped on ice. Site is not a spill location so no ice shipment and long hold time prior to analysis will not impact results.

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample #	Sample ID Description	Filtered? Y/N	ANALYSES REQUESTED: USEPA PAH 16	Total # Containers	Designated MS/MSD	CT Lab ID # *Lab use only*
9/25	11 AM	S	Comp	1	~~Sieved Soil~~ Sporting Clay Soil		X	1		1260865

Fill in Spaces with Bottles per Test

Turnaround Time
(Normal) RUSH*
Date Needed: ______
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	11/7/22	[signature]	11/8/22 923
Received by:	Date/Time	Received for Laboratory by: [signature]	Date/Time 11/8/22 947

Lab Use Only
Ice Present Yes No
Obs. Temp Amb IR Gun –
Act. Temp – Cooler box