Table 3 presents selected concentrations of elements found in sediments from dug holes at Cadogan Site

Community Driven Research: Preliminary Exposure Assessment and Results of Water Sampling Along the Allegheny River Associated with Legacy Contamination at the Former Pittsburgh Plate Glass Industries, Inc. Cadogan Waste Disposal Site

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Background and Overview

Formerly the largest plate glass factory in the world, Pittsburgh Plate Glass Inc. (PPG) operated for over 100 years in Ford City, Pennsylvania, approximately 40 miles northeast of Pittsburgh on the Allegheny River. The plant produced commercial construction glass and fabricated architectural colored glass. Industrial glass chemical processing consists of fusing pure silica (SiO2) with common oxides: Calcium oxide (CaO), and sodium carbonate (Na2CO3). Fe, Mn, Co, Zn, Cd, Se, Sb, Mg, Su, Cu, Pb, As, and Hg are elements that were used in glass production processes to produce special properties such as; color, transparency, and hardness. The Cadogan waste site is located on a cliff along the descending right bank of the Allegheny River, downstream and on the opposite side of the river from the Ford City Plant. This waste site was used for the disposal of a host of metals/metalloids and elements; fashioned glass breakage and scrap products; volatile and semi-volatile organic compounds, and PCB's that were associated with the glass manufacturing techniques of the time.

Community concern for site conditions were demonstrated through numerous environmental public health prioritization processes held as part of the Allegheny River Stewardship Project (ARSP) in the winter of 2007-2008, this site ranked in the top three environmental issues for all surveyed groups. Subsequent visual observation by community members and the research team revealed an extended cliff face with runoff waterfalls from the cliff top; and leechate from the cliff face, covered in a whitish precipitate, directly cross-channel west from the mouth of the Crooked Creek. The cliffside is devoid of vegetation except for tree remnants that may indicate more recent biotic exposure because of changes in effluent flow rates (Figure 1).

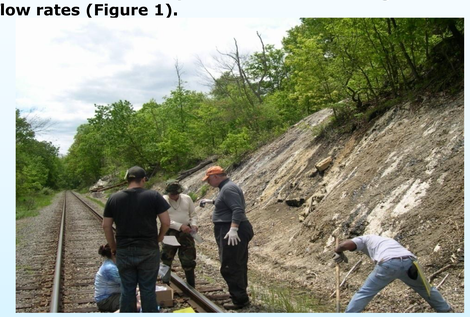

Figure 1, Cadogan Cliff Degradation

The work described in this poster represents the results of preliminary sampling of waterfall effluent (Figure2) and groundwater from four (4) dug holes, six (6) inches above the constant hydraulic head at the river-bank boundary for a suite of elements. Additionally, pH measurements were taken along upstream and downstream transects, representing a control volume for the site. pH readings were also taken of the waterfall effluent, dug holes and along described transects on the river bottom at 1, 2 and 3 meters in depth. This release of preliminary data does not include all water and sediment samples and other water indicator parameters taken at this site nor have statistical tests been performed. The sampling data presented is contrasted to both regulatory and guideline contaminant concentration criteria determined by both the US EPA and Environment Canada for both water and sediment so an evaluation can be made to help determine additional work to be done at this site.

Figure 2, Runoff Watercourse, brownish effluent and white precipitate at 40°45.261" N 079°33.435" W, right downstream bank south of Ford City

Objectives

1. **Provide a preliminary assessment of reviewed data to characterize potential contamination and evaluate exposure pathways to human and ecological receptors from runoff water, leechate and contaminated sediments.**
2. **Measure indicators of water quality and levels of known contaminant elements in runoff surface water, groundwater, river water and sediments.**
3. **Compare current conditions of contaminated media to data collected through Department of Environmental Protections (DEP) files review to determine the dynamic nature of the site, as previous remediation was based on assessments performed 15-40 years ago.**
4. **Preliminarily assess environmental media for toxic elements and compare found levels to known standards.**
   Begin the determination process of the potential for this site adding appreciable mass of contaminants to the Allegheny River and determine if existing effluents could potentially harm human health or the environment.

Methods

1. The following PA DEP file studies for this PPG site were reviewed and evaluated to determine elements and indicators for water and sediment sampling work.
   Cummings Riter Works #5 Facility RI Report (2001)
   RI investigation by Baker Environmental (1993)
   RI Investigation by Dames & Moore (1992)
   FIT Site inspection Report by Ecology and Environmental, Inc. (1991)
   D'Appolonia Report (1971)

2. River water and sediment samples were collected using a 1.7L Niskin by General Oceanics and ponar style sediment grab by Wildco, respectively.

3. Seven (7) Allegheny River sampling transects were formulated with a Garmin Mapsource Topo 2008. Top, middle, and bottom water samples were taken from each waypoint along each transect, as well as sediment samples. Real time water indicator variables such as conductivity, total dissolved solids and dissolved oxygen were collected using a Hanna Instrument 9128 multi-parameter water probe. Only pH measurements are presented in this set of preliminary data.

4. Transects 003, 004, 005, and 006 extend perpendicularly from riverbank excavated holes (1-4) to obtain levels of elemental contaminants in groundwater (6 inches above the riverbank) and at 1, 2 and 3 meter depths and in river sediment.

5. Water and sediment samples were analyzed according to EPA accepted ICP-MS methods for As, Pb, Co, Cu, Cd, Cr, Hg, Mn, Se and Zn levels.

Results

- Previous and current site investigations have detected organic and inorganic constituents in surface soil, surface water, sediment, effluent and groundwater.
- Lead and Arsenic concentrations have been found to be of significant concern through EPA and PADEP human and ecological risk assessments.
- Effluent pH had a maximum value of 10.94, see Table 1

Table 1, pH values in Sampled Water

Transect	Max. pH	Mean pH	# Samples
Effluent 1,2	10.94	10.80	3
Riverbank Holes	9.81	9.18	4
Tributary Stream	9.81	9.25	3
Glade Run	7.73	7.66	6
002-upstream transect	7.84	7.58	23
003	9.36	8.37	4
004	8.15	8.06	3
005	8.41	8.23	3
006	8.07	8.03	3
007-downstream transect	8.18	7.93	15

Figure 3, Riverbank Holes (red) and River transects 3, 4, 5, 6 (sampling locations-blue)

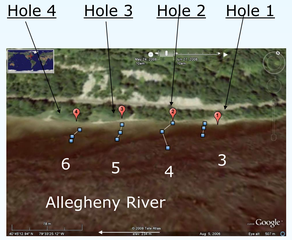

Table 2 presents concentrations of elements found in waterfall effluent and dug hole (groundwater.) at Cadogan Site

Table 2

Sample	As (ppb)	Hg (ppb)	Cd (ppb)	Pb (ppb)	Cu (ppb)	Mn (ppb)
Detection Limit (Effluent) (Hole Water)	0.07 0.38	0.06 0.04	0.02 0.07	0.07 0.02	0.79 0.02	0.24 0.07
Waterfall Effluent 1, EF1	164.10	2.81	1.12	131.73	40.94	44.30
Waterfall Effluent 2, EF2	67.10	9.75	0.79	29.87	103.65	67.52
Waterfall Effluent 2, EF2 Duplicate	70.69	6.70	0.78	33.95	19.63	65.48
Hole 1, 6"above river level	14.21	BDL	0.35	12.35	16.57	250.82
Hole 2, 6" above river level	90.73	0.25	0.29	10.91	34.35	411.18
Hole 3, 6" above river level	14.76	0.24	0.16	3.07	12.54	236.00
Hole 4, 6"above river level	1.00	BDL	BDL	2.31	3.53	263.46

Table 3 presents selected concentrations of elements found in sediments from dug holes at Cadogan site.

Table 3

Sample	As (mg/kg)	Pb (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Mn (mg/kg)
Hole 1	17.04	43.18	1.2	33.59	2562.25
Hole 2	13.12	32.74	0.97	25.08	3240.27
Hole 3	9.65	40.46	0.91	16.58	2467.74
Hole 4	13.08	50.85	1.67	35.14	2287.58

Table 4 presents both regulatory limits and guidelines for acceptable concentrations of contaminant elements in water and sediment

Element	EPA Drinking Water Standard (ppb)[1]	Freshwater CMC (ppb)[2]	MCLG (ppb)[3]	Canadian PEL[5]/ISQG[6] Sediment (mg/kg)
Arsenic	10	340	0	17/5.9
Cadmium	5	2.0	5	3.5/0.6
Copper	1300	13	1300	197/35.7
Lead	15	65	0	91.3/35
Manganese	50 [4]			1200[7]
Mercury	2	1.4	2	0.49/0.17

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Conclusions

Arsenic (As) concentrations all waterfall effluents and 3 of 4 hole water samples exceed the US EPA Drinking Water Standard.; As in hole sediments range from .6-1X and 1.6 to 2.9X the Canadian PEL and ISQW respectively.

Mercury (Hg) in all waterfall effluents exceeds the US EPA Drinking Water Standard (range 1.4-4.9X). Hg in waterfall effluent is approximately 7X the CMC.
Cadmium (Cd) in hole sediments ranges from 1.6 to 2.8 times the Canadian ISQG.

Lead (Pb) in waterfall effluent exceeds the EPA Drinking Water Standard in all samples (range 2.0 to 8.8X) and the CMC in one sample by a factor of 2. Pb in hole sediment exceeds the ISQG in 3 of 4 samples.

Copper (Cu) exceeds the Freshwater CMC in all samples, in one by a factor of 8. Cu in hole water exceeds the CMC in 2 of 4 holes.

Manganese (Mn) exceeds the NSDWR secondary water standards in 2 of 3 waterfall effluent samples and in all hole water samples. The Mn level in hole sediments exceeds the Missouri PEL in all samples (range, 1.9-2.7X).

Fish cannot survive in water with a pH of 10.10; this effluent stream will cause fish in river to flee.

Public Health Implications

Past human risk assessments have deemed lead and arsenic exposure from groundwater and surface soils as area of greatest concern.
The research crew developed irritation of the mucous membranes while in close proximity to the cliff face, additionally one pair of nitrile gloves dissolved during sampling in a dug hole. This effect is hypothesized to be due to high concentrations of alkaline mists and the high pH of runoff waters.
Cadogan township drinking water intake is located ¾ mile downstream from the waste site.
Signs should be immediately posted warning boaters, anglers, swimmers and hikers to avoid this area and should be visible from both land and water side approaches.
Bioaccumulation of toxic metals/elements can occur in fish and can pose risks if consumed.

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