Analysis of Metals in Red-tailed Hawk Blood From PGDP

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FINAL REPORT

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Over the past several months, we have received requests to analyze samples of avian blood. These were “collections of opportunity” by FFOU personnel intended to be used for preliminary screening of PCBs and metals and for prioritizing further studies.

This report presents the results for eight metals of concern (MOC, *i.e*. Ag, Be, Cd, Cr, Cu, Ni, Pb and Zn) analyzed in four red-tailed hawk blood samples collected from the PGDP area.

METHODS

Tissue extraction and clean-up

Metals in red-tailed hawk whole blood samples were digested according to modified procedures described by Shaw *et al.* (1998), Hogstrand *et al*. (1996), and U.S. EPA (1997). A 500 µL sub-sample of whole blood was removed from the original sample and digested with 2.0 mL TraceMetal grade concentrated HNO_3. The sub-samples were then heated (100^oC/2h), allowed to cool at room temperature and, once complete digestion was achieved, 300 µL of 30% H_2O_2 was added to each sample followed by heat-instilling until dry. The samples were then reconstituted to 2.0 mL with 0.5 % HNO_3 in deionized water.

Metal Analyses

Analyses of whole blood samples were performed by atomic absorption spectrophotometry (AAS) using a Varian AAS (Model Spectra AA-20) with a GTA-96 graphite furnace (U.S. EPA, 1997). All gases used were ultra pure carrier grade. Calibration curves were based on five standards. The instrument was programmed to take three readings per sample and average the absorbance. Instrument blanks (0.5 % HNO_3) and check standards were processed with all samples. Sample concentrations were then corrected for deviations from the standards, and final wet weight was factored into the calculation of final values.

Quality Assurance

Copies of all chain of custody forms and permanent records are maintained in active files and are available for review by FFOU or the Cabinet for Natural Resources and Environmental Protection. Original chain of custody forms were maintained by FFOU. Quality assurance for metal assays included blanks, chicken blood controls and check standards (U.S. EPA, 1997; Birge and Price, 1997).

RESULTS

Metal concentrations for whole blood from red-tailed hawks are given in Table 1, together with "reference" values for chicken blood. Mean values were not given for hawk blood due to the fact that they were collected on different dates and at different locations. As there was no hawk blood available from a specified reference site, it was necessary to use chicken blood for background or "reference" values. In addition, our regular sample coding system could not be used as no specific collection site was given.

Highest values for silver (Ag) and cadmium (Cd) were observed in hawk No. 1, which also contained the highest PCB concentration (Price and Birge, March 1998). Hawk No. 3 contained elevated whole blood concentrations of copper (Cu), lead (Pb), nickel (Ni) and zinc (Zn), as compared with mean values for chicken blood. It is important to note that lead was not elevated in the other three hawks. Metals have a shorter half-life in blood than in most other tissues (*e.g*. liver), and, therefore, blood values are not necessarily the best measure of metal exposure. In addition, certain metals (*e.g*. Cu, Zn) are effectively down-regulated in homeotherms that experience exposure to metal pollution. Based on these results, future monitoring for metals may not prove worthwhile.

Table 1. Metal Assays of Hawk Blood Collected from PGDP Area.

	Concentration (µg/L)							
Sample Number	Ag	Be	Cd	Cr	Cu	Pb	Ni	Zn
Hawk Blood051497#1	94.13	8.79	183.36	5.70	14.37	12.87	25.52	103.26
Hawk Blood071697#2	11.96	15.81	41.56	6.89	26.33	8.83	10.16	150.33
Hawk Blood080897#3	19.05	24.15	91.60	11.45	45.65	31.30	61.81	573.33
Hawk Blood081297#4	47.51	13.70	108.08	8.28	18.62	14.32	24.39	136.05
Chicken Blood062497#4A[a]	43.00	11.74	135.73	7.08	19.01	18.10	38.84	144.47
Chicken Blood062497#4B	69.06	9.18	166.99	6.71	10.17	14.45	26.83	144.58
Mean	56.03	10.46	151.36	6.90	14.59	16.27	32.83	144.52
Lysis Buffer091097#1[b]	3.62	64.70	19.28	67.80	38.90	<13.81	21.04	1152.90
Lysis Buffer091097#2	3.62	77.14	26.81	49.39	112.11	33.09	110.77	2434.94
Mean	3.62	70.92	23.05	58.60	75.50	33.09	65.90	1793.92

[a]Chicken blood samples were extracted along with hawk blood samples and used as background or reference concentrations.

[b]Lysis buffer (4M Urea, 0.2M NaCl, 0.1M Tris-HCl, 0.01M CDTA, 0.5% N-lauryl sarcosine) was added to clotted samples of Hawk Blood071697#2 (0.25 mL) and Hawk Blood081297#4 (0.50 mL).

REFERENCES

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