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EVALUATION OF CONTAMINANT RESIDUES IN DELAWARE BAY BALD EAGLE NESTLINGS

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Department of the Interior
U.S. Fish and Wildlife Service
New Jersey Field Office

and

The New Jersey Department of Environmental Protection
Division of Fish, Game and Wildlife
Endangered and Nongame Species Program

In Cooperation With

The Delaware Department of Natural Resources and Environmental Control
Division of Fish and Wildlife
Nongame and Endangered Species Program

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EVALUATION OF CONTAMINANT RESIDUES IN DELAWARE BAY BALD EAGLE NESTLINGS

Prepared by:

U.S. Fish and Wildlife Service
Ecological Services, Region 5
New Jersey Field Office
Pleasantville, New Jersey 08232

Preparer / Project Biologist: Mark R. Roberts
Assistant Project Leader: Robert A. Frakes, Ph.D.
Project Leader: Clifford G. Day

and

New Jersey Department of Environmental Protection
Division of Fish, Game and Wildlife
Endangered and Nongame Species Program
Tuckahoe, New Jersey 08205

Project Biologist: Kathleen E. Clark
Project Leader: Lawrence J. Niles

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PREFACE

The information presented in this technical assistance report documents a contaminants evaluation of bald eagle nestling blood and feathers collected from the lower Delaware River Basin in New Jersey and Delaware. The study was initiated to document baseline contaminant levels in this species.

This contaminants investigation was a collective effort among the U.S. Fish and Wildlife Service's New Jersey Field Office (NJFO), the New Jersey Department of Environmental Protection's Endangered and Nongame Species Program (ENSP), and the Delaware Department of Natural Resources and Environmental Control's Nongame and Endangered Species Program (NESP). The study design, data analyses, and reporting were completed primarily by environmental contaminants personnel in the NJFO. The nest monitoring, nest climbing, and physical sample collection were completed primarily by ENSP, NESP, and volunteer personnel. Funding for the project was provided by Region 5 of the U.S. Fish and Wildlife Service and the New Jersey Endangered Species Conservation Fund.

Questions, comments, and suggestions related to this report are encouraged and should be submitted in writing to the following address:

U.S. Fish and Wildlife Service
Ecological Services
927 North Main Street (Building D-1)
Pleasantville, New Jersey 08232

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ABSTRACT

Bald eagle (*Haliaeetus leucocephalus*) nesting attempts have steadily increased over the past decade in the Delaware Bay and River drainage basin; however, nesting success continues to be moderate. In this investigation, bald eagle nestling plasma, packed cells, and feathers were chemically analyzed to document baseline contaminant concentrations in the Delaware Bay population. Twelve plasma samples were analyzed for organochlorines. Geometric mean concentrations of DDD, DDE, and total PCBs were 11, 32, and 120 ppb wet weight, respectively. Eight packed cell samples were analyzed for inorganic contaminants, with mercury and selenium levels being the most notable results. Geometric mean concentrations were 606 and 233 ppb wet weight, respectively. Analysis of twelve nestling breast feather samples resulted in geometric mean concentrations of mercury and selenium of 2.9 and 1.7 ppm dry weight, respectively. A single addled egg was analyzed and contained significant adjusted wet weight concentrations of total PCBs (28.1 ppm), DDD (2.7 ppm), and DDE (13.9 ppm). Blood contaminant levels were generally lower than those reported for Maine (U.S. Fish and Wildlife Service, 1994a) and the Great Lakes breeding areas (Bowerman et al., 1994a), and were generally higher than those encountered in the Great Lakes inland breeding areas (Bowerman et al., 1994a) and the Pacific Northwest (Anthony et al., 1993). The blood analysis documented current nestling exposure to PBCs, DDE, and mercury, all of which may contribute to the low to moderate productivity observed in the Delaware Bay bald eagle population. Concentrations of DDD, DDE, and total PCBs in the addled egg may have contributed to the nest failure (Wiemeyer et al., 1993). Additional monitoring of nests and chemical analysis of recovered eggs, including congener specific PCBs, pesticides, and mercury, are recommended. The H4IIE bioassay procedure should also be performed on all eggs to elucidate potential toxicity of PCB congeners producing dioxin-like effects.

I. INTRODUCTION

The bald eagle is listed as a threatened species by the federal government and an endangered species by the States of New Jersey and Delaware. Bald eagle nesting attempts have steadily increased over the past decade in the Delaware Bay and River drainage area; however, nesting success continues to be moderate. Contaminant residues in southern New Jersey fauna may be linked to reduced productivity of Delaware Bay populations of osprey (*Pandion haliaetus*) (Steidl et al., 1991a) and have been implicated in reproductive impairment of federal- and state-listed endangered peregrine falcons (*Falco peregrinus*) in New Jersey (U.S. Fish and Wildlife Service, 1991; Steidl et al., 1991c). The U.S. Fish and Wildlife Service's (Service) New Jersey Field Office (NJFO) has previously documented significant bioaccumulation of DDE and PCBs in adult peregrine falcons from southern New Jersey; whole body DDE levels in one bird may have been high enough to have caused reproductive impairment (U.S. Fish and Wildlife Service, 1991). Reproductive studies have found that eggs of ospreys nesting along the Delaware Bay have significantly higher levels of PCBs and DDT-related contaminants than do those found nesting along the surrounding New Jersey Atlantic coast (Steidl et al., 1991b). These contaminants were suggested to contribute to decreased productivity in the Delaware Bay nesting ospreys, as a higher frequency of unhatched eggs and thinner eggshells were evident in this colony (Steidl el al., 1991a). The suspected cause and effect relationship between contaminants and reproductive success, if accurate, would perhaps be more evident in the bald eagle. The bald eagle consumes larger prey and a greater quantity of prey than the osprey, and bald eagles reside year-round in the Delaware Bay region.

The Endangered and Nongame Species Program, New Jersey Division of Fish, Game and Wildlife (NJDFGW) has monitored bald eagle nesting and reproduction since 1974 (Niles, 1989), and has compiled historic nesting data for Delaware Bay since 1935. An intensive restoration project conducted from 1982 through 1989 resulted in new bald eagle nesting attempts in New Jersey (Niles et al., 1991). The Nongame and Endangered Species Program, Delaware Division of Fish and Wildlife (DEDFW) has monitored bald eagle productivity on an annual basis since 1978, compiled historic records, and is in the process of restoring its bald eage population. Significant contaminant residues in Delaware Bay bald eagles could threaten the continued recovery of the population. Other researchers (Bowerman, 1991, 1993, and 1994a; Anthony et al., 1993; and U.S. Fish and Wildlife Service, 1994a) have implicated contaminants in low reproductive success of bald eagles in the Great Lakes Region, the Columbia River estuary, and Maine, respectively; however, baseline data concerning the Delaware Bay population are lacking.

This investigation will serve to determine background contaminant levels in Delaware Bay nestlings, and identify potential problem areas which may require additional study, monitoring, or special management. Data will aid interpretation of existing productivity data on bald eagles in the Delaware Bay area, and help establish or refute the suggested adverse effect of contaminants on reproduction. The investigation objectives were to: 1) characterize levels of organochlorines and elemental contaminants in blood of bald eaglets occupying the Delaware Bay area, and 2) determine elemental contaminant levels via analysis of breast feathers and compare to blood inorganic results.

II. METHODS

A. BLOOD, FEATHER, AND EGG COLLECTIONS

Blood and feathers were collected during two consecutive field seasons (Spring, 1992 and 1993) in Delaware and New Jersey (Figure 1). Sample identification, dates of collection, and general nest locations appear in Table 1. Active bald eagle nests were monitored weekly from the time of mature eagle arrival to document nesting success and establish timing of chick development. The nest monitoring was conducted by NJDFGW and DEDFW staff, and several volunteers working for the above agencies. Several overflights were also used to confirm active nests.

Approximately 10 ml of whole blood was collected from 5 to 9 week old nestlings in New Jersey (seven nestlings) and Delaware (five nestlings) during routine banding operations by NJDFGW and DEDFW staff biologists and volunteer veterinarians. Blood was collected from the brachialus vein using sterile techniques with heparinized syringes fitted with 22 or 23 gauge needles. The sample was transferred to a 10 ml Vacutainer tube containing freeze-dried sodium heparin and kept on wet ice at 4°C. Samples were centrifuged within 24 hours of collection. Blood plasma was transferred to a clean Vacutainer tube and both plasma and packed red blood cells were frozen until shipment to the analytical laboratory. Three to five breast feathers were removed from each eaglet and stored in a labeled, air tight, zip-loc bag at room temperature. A single addled egg was collected from a nest in Gloucester County, New Jersey in 1993. The egg was dissected in the laboratory and an autolyzed full-term embryo was placed in a chemically clean glass jar with a teflon-lined cap. All samples were stored in original sample containers in a freezer (-20 degrees Celsius) and shipped to the chemical laboratories on dry ice on September 13, 1993.

B. ANALYTICAL DETERMINATIONS

Inorganic analyses of packed red blood cells, feathers, and the egg contents were conducted at Hazleton Environmental Services, Inc., Madison, Wisconsin. Inorganic analytes included: arsenic, cadmium, lead, mercury, and selenium. Mercury was quantified by automated cold vapor atomic absorption; the other elements were quantified by graphite furnace atomic absorption. Percent moisture was calculated for the egg contents only, as mass was insufficient for moisture analysis in packed cells and feathers.

Organic analyses of plasma and the egg contents were conducted at Mississippi State Chemical Laboratory, Mississippi State, Mississippi. Organic analytes are listed in Table 2, and were quantified by electron capture gas chromatography. Percent lipid was determined for all samples; however, only the egg contents contained sufficient mass for percent moisture determination.

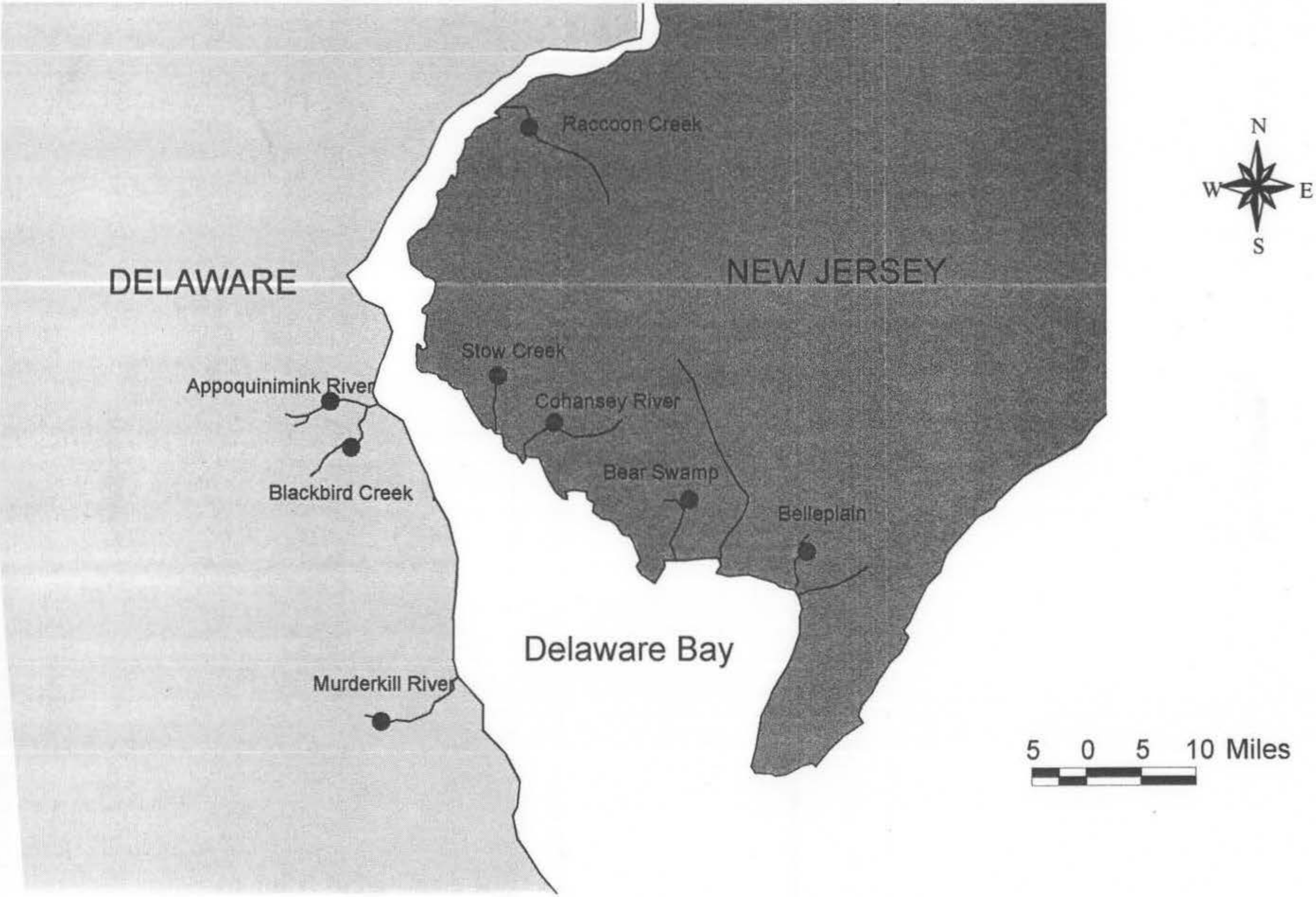

Figure 1. Bald Eagle Nest Locations Sampled in Delaware and New Jersey, 1992-1993.

Table 1. Bald Eagle Nest Information and Samples (grams) Collected From Delaware and New Jersey Nestlings, 1992-1993.

SAMPLE ID	COUNTY / STATE	LOCATION	DATE	EST - AGE	EST - SEX	PLASMA	PACKED CELLS	FEATHERS	EGG
APP92-1	New Castle, Delaware	Appoquinimink River	5/14/92	37 days	Unknown	5.02	N/A	0.06	N/A
APP92-2	New Castle, Delaware	Appoquinimink River	5/14/92	35 days	Unknown	6.51	1.618	0.059	N/A
APP93-1	New Castle, Delaware	Appoquinimink River	6/9/93	50 days	Unknown	5.79	2.074	0.05	N/A
BEA-93-1	Cumberland, New Jersey	Bear Swamp	5/28/93	59 days	Female	5.31	1.969	0.129	N/A
BEL92-1	Cape May, New Jersey	Belleplain	5/13/92	53 days	Male	6.24	N/A	0.142	N/A
BEL92-2	Cape May, New Jersey	Belleplain	5/13/92	54 days	Male	6.56	0.944	0.114	N/A
BLA92-1	New Castle, Delaware	Blackbird Creek	5/14/92	48 days	Unknown	6.04	N/A	0.081	N/A
BLA93-1	New Castle, Delaware	Blackbird Creek	5/6/93	56 days	Male	5.28	1.749	0.096	N/A
COH93-1	Cumberland, New Jersey	Cohansey River	5/10/93	44 days	Male	5.19	2.005	0.049	N/A
MUR93-1	Kent, Delaware	Murderkill River	5/13/93	50 days	Male	4.81	1.991	0.068	N/A
STO92-1	Cumberland, New Jersey	Stow Creek	5/13/92	43 days	Female	5.27	N/A	0.105	N/A
STO93-1	Cumberland, New Jersey	Stow Creek	5/10/93	49 days	Male	6.15	0.796	0.043	N/A
RACC93-1	Gloucester, New Jersey	Raccoon Creek	5/1/93	Unknown	Unknown	N/A	N/A	N/A	63.7

Table 2. Organochlorine Contaminants Analyzed in Plasma, Delaware and New Jersey Nestlings, 1992 - 1993[1].

HCB	toxaphene
alpha-BHC	dieldrin
beta-BHC	endrin
delta-BHC	mirex
gamma-BHC	o,p'-DDE
heptachlor epoxide	p,p'-DDE
oxychlordane	o,p'-DDD
alpha-chlordane	p,p'-DDD
gamma-chlordane	o,p'-DDT
trans-nonachlor	p,p'-DDT
cis-nonachlor	Aroclor 1242
Aroclor 1248	Aroclor 1254
Aroclor 1260	

1 Lower limit of detection for all tissue was 0.01 ppm (except for toxaphene and PCB Aroclors which were 0.05 ppm).

C. DATA CONVERSIONS AND ANALYSIS

1. Blood

All plasma results are reported on a wet weight basis. For those compounds not detected in blood samples, a value of one-half the detection limit was used in calculating geometric means. Only Aroclors 1254 and 1260 were used to estimate total PCBs, as the other Aroclors were not detected in any sample. Geometric means of inorganic compounds in packed cells were calculated by using one-half the detection limit for non-detected analytes.

2. Feathers

Contaminant concentrations in feathers were reported by the laboratory in wet weights and dry weights. However, since most comparative data are in dry weights, all contaminant concentrations in feathers are presented in dry weights in this report. Geometric means of inorganic compounds in feather samples were calculated by using one-half the detection limit for non-detected analytes.

3. Addled Egg

The contaminant concentrations in the egg contents were reported by the laboratory in dry and wet weight. The latter was adjusted for moisture loss to ppm fresh weight. The egg volume was estimated (Stickel et al., 1973) and detected concentrations were adjusted by an egg wet weight to egg volume ratio assuming a specific gravity of 1.0 (Stickel et al., 1966).

4. Statistical Analysis

Simple correlation analysis was used to relate inorganic concentrations in blood to concentrations in feathers. Statistical tests were performed at the 0.05 level of significance.

III. RESULTS

A. BLOOD

A total of 12 plasma samples were submitted for organic contaminant analysis and 8 corresponding packed red blood cell samples were submitted for inorganic analysis. Organic compounds detected in plasma included PCB Aroclors 1254 and 1260, dieldrin, DDE, and DDD. Total PCBs were detected in 92 percent of the samples and at a geometric mean concentration of 120 ppb wet weight (range <50 - 280 ppb). The compound DDE was detected in all samples at a geometric mean of 32 ppb wet weight (range 18 - 64 ppb). Dieldrin and endrin were the only other organic contaminants detected in Delaware Bay nestling plasma at geometric mean concentrations of 8 and 6 ppb, respectively. A summary of concentrations detected, detection frequency, and geometric means may be found in Table 3.

All inorganic contaminants analyzed were detected in packed cells, except cadmium. Mercury was detected in all samples at a geometric mean concentration of 233 ppb wet weight. A summary of inorganic analytes detected, detection frequency, and geometric means are also shown in Table 3.

B. FEATHERS

A total of 12 feather samples were submitted for inorganic analysis and all five inorganic contaminants analyzed were detected in the feather samples. A summary of inorganic analytes detected, detection frequency, and geometric means in feathers are also shown in Table 3. Lead, mercury, and selenium were detected in 100 percent of the blood and feather samples. The correlation analyses did not detect a significant correlation ($p>0.05$) between blood and feather levels of mercury ($r = 0.567$), lead ($r = -0.176$), or selenium ($r = -0.329$).

C. ADDLED EGG

Results of organic and inorganic analyses of the addled egg can be found in Table 4. Most notably, the egg contents contained 28.1 ppm total PCBs (fresh weight), 13.9 ppm DDE (fresh weight), and a variety of other pesticides.

IV. DISCUSSION

A. BLOOD

1. PCBs

Plasma samples from Michigan bald eaglets were found to contain the following mean concentrations of total PCBs (ppb wet weight) as grouped by nest site location: (1) Great Lakes, 243.5 (range 33.0 - 520.0 ppb); riverine, 41.2 (range 13.0 - 84.0 ppb); and, inland lakes 27.7 (range 8.0 - 61.0 ppb) (Bowerman, 1991). Bowerman et al. (1994a) summarized results of bald eaglet plasma analysis for 121 samples taken from the Great Lakes areas of Michigan, Minnesota, Ohio, Ontario, and Wisconsin in 1989. Arithmetic mean concentrations of total PCBs were 183 ppb (range 33 - 520 ppb), and 24 ppb (range 5 - 200 ppb) for the Great Lakes and interior breeding areas, respectively.

Table 3. Summary of Organic and Inorganic Contaminants Detected in Bald Eagle Plasma, Packed Cells, and Feathers, Delaware and New Jersey Nestlings, 1992-1993.

ANALYTE	n	GEOMETRIC MEAN[1]	MEDIAN	MINIMUM	MAXIMUM	LOD[2]	FREQUENCY
PLASMA (ppm wet weight)							
PCB-1254	12	0.057	0.054	<LOD	0.140	0.050	9 of 12
PCB-1260	12	0.056	0.070	<LOD	0.160	0.050	7 of 12
TOTAL PCBs	12	0.120	0.099	<LOD	0.280	0.050	11 of 12
Dieldrin	12	0.008	0.005	<LOD	0.022	0.010	6 of 12
Endrin	12	0.006	0.005	<LOD	0.011	0.010	2 of 12
p,p'-DDD	12	0.011	0.010	<LOD	0.034	0.010	8 of 12
p,p'-DDE	12	0.032	0.027	0.018	0.064	0.010	12 of 12
PACKED CELLS (ppm wet weight)							
Arsenic	8	0.031	0.030	<LOD	0.090	0.050	1 of 8
Lead	8	0.098	0.100	0.060	0.130	0.050	8 of 8
Mercury	8	0.233	0.197	0.141	0.433	0.010	8 of 8
Selenium	8	0.606	0.560	0.420	0.910	0.100	8 of 8
FEATHERS (ppm dry weight)							
Arsenic	12	0.189	0.210	<LOD	0.370	0.050 - 0.470	4 of 12
Cadmium	12	0.580	0.560	<LOD	2.000	0.060 - 0.410	11 of 12
Lead	12	4.976	6.080	1.610	17.100	0.100	12 of 12
Mercury	12	2.917	2.680	1.780	8.380	0.010	12 of 12
Selenium	12	1.697	1.600	0.850	12.100	0.100	12 of 12

[1]One-half the LOD was used to calculate the mean and median for those samples <LOD.
[2]Limit of Detection.

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Table 4. Organic and Inorganic Contaminants in a Single Addled Bald Eagle Egg (ppm) from New Jersey, 1993.

ANALYTE	DRY WEIGHT	WET WEIGHT	FRESH WEIGHT[1]
HCB	0.183	0.038	0.020
PCB-1242	<LOD[2]	<LOD	<LOD
PCB-1248	<LOD	<LOD	<LOD
PCB-1254	115.385	24.000	12.720
PCB-1260	7.000	29.000	15.370
Total PCBs	254.808	53.000	28.090
alpha BHC	<LOD	<LOD	<LOD
alpha Chlordane	4.808	1.000	0.530
beta BHC	0.231	0.048	0.025
cis-Nonachlor	2.067	0.430	0.228
delta BHC	<LOD	<LOD	<LOD
Dieldrin	3.173	0.660	0.350
Endrin	<LOD	<LOD	<LOD
gamma BHC	0.269	0.056	0.030
gamma Chlordane	<LOD	<LOD	<LOD
Heptachlor epoxide	1.154	0.240	0.127
Mirex	0.288	0.060	0.032
o,p^{1}-DDD	<LOD	<LOD	<LOD
o,p^{1}-DDE	1.346	0.280	0.148
o,p^{1}-DDT	<LOD	<LOD	<LOD
Oxychlordane	0.962	0.200	0.106
p,p^{1}-DDD	24.038	5.000	2.650
p,p^{1}-DDE	125.000	26.000	13.780
p,p^{1}-DDT	0.288	0.060	0.032
Toxaphene	<LOD	<LOD	<LOD
trans-Nonachlor	6.730	1.400	0.742
Arsenic	<LOD	<LOD	<LOD
Cadmium	<LOD	<LOD	<LOD
Lead	0.330	0.070	0.037
Mercury	0.665	0.141	0.075
Selenium	2.170	0.460	0.244

[1]Fresh weight conversion factor of 0.53 based on Stickel et al. (1973).
[2]Limit of Detection.

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Bald eagle nestlings in Maine were found to contain some of the highest PCB blood levels in the country. Results reported for Maine eaglets are for whole blood; therefore, Maine results were multiplied by a factor of two to estimate plasma concentrations for comparison (U.S. Fish and Wildlife Service, 1994a). The estimated Maine plasma PCB mean concentration in 1991 was 180 ppb wet weight (range <100 - 5520 ppb). The estimated Maine plasma PCB mean concentration in 1992 was 368 ppb wet weight (range <50 - 24254 ppb). The highest total PCB blood levels were obtained from Maine eaglets occupying coastal nests, and coastal PCB blood levels were significantly higher than those found in inland eaglets.

Wiemeyer et al. (1989) found whole blood total PCB levels from Oregon nestling bald eagles ranged from <50 ppb to 290 ppb; however, only 15% of the samples exceeded 50 ppb. Mean PCB concentrations in whole blood of bald eagle nestlings, subadults, and adults of the Columbia River estuary were 40, 530, and 2400 ppb, respectively (Anthony et al., 1993). Geometric mean PCB residues in whole blood samples from subadult and adult eagles wintering in the Klamath basin of Oregon and California were 14 and 18 ppb, respectively (Frenzel and Anthony, 1989).

Although the levels of PCBs contained in bald eaglet plasma from the Delaware Bay are not as high as those reported from the Great Lakes shoreline ecosystem or Maine, they are markedly higher than the interior Great Lakes ecosystem and also generally higher than those reported from Oregon and California, including the Columbia River estuary. Bowerman (1991) concluded that DDT derivatives and PCBs were the primary contaminants causing low bald eagle productivity within 8.0 kilometers of the Great Lakes in the Michigan Upper Peninsula. Contrarily, U.S. Fish and Wildlife Service (1994a) found that PCB concentrations in nestling blood were not significantly correlated with mean five- or fifteen-year productivity, and suggested that the lack of significant correlation may be caused by several factors. First, the nestling blood contaminant concentrations probably reflect only current exposure of contaminants through the nestling diet, and not the cumulative contaminant exposure of the breeding adults. Secondly, Maine suffers from a low bald eagle productivity rate state-wide; therefore, no true reference site exists with which to make valid comparisons. Lastly, congener specific analysis and measurements of toxicity such as the H4IIE bioassay are imperative to correlate specific contaminant concentrations to adverse reproductive effects.

One certainly cannot rule out PCBs as a potential reproductive inhibitor in Delaware Bay bald eagles. Embryotoxic contaminants such as PCBs have been suggested to adversely affect osprey (Steidl et al., 1991a and 1991b) and peregrine falcon (Steidl et al., 1991c) productivity in the Delaware Bay area. The PCB plasma levels found in the Delaware Bay nestlings certainly warrant further investigation.

2. DDT Metabolites

Bowerman et al. (1994a) reported arithmetic mean bald eaglet plasma concentrations of DDE at 61 ppb (range 13 - 306 ppb), and 20 ppb (range 2 - 193 ppb), for the Great Lakes and interior breeding areas, respectively. Mean DDE concentrations in whole blood of bald eagle nestlings, subadults, and adults of the Columbia River estuary were 50, 310, and 2130 ppb, respectively (Anthony et al., 1993). Geometric mean DDE residues in whole blood samples from subadult and adult eagles in the Klamath Basin of Oregon and California were 42 and 30 ppb, respectively (Frenzel and Anthony, 1989).

The estimated Maine plasma DDE mean concentration (estimated from whole blood levels as previously described) in 1991 was 60 ppb wet weight (range <10 - 4378 ppb). The estimated Maine plasma DDE mean concentration in 1992 was 162 ppb wet weight (range <10 - 2600 ppb). Total DDE blood levels obtained from Maine eaglets occupying coastal nests were significantly higher than those found in inland eaglets. There was a significant positive correlation between DDE concentration in nestling blood and mean five-year productivity at nest sites in Maine; however, this positive correlation was the first ever suggested (U.S. Fish and Wildlife Service, 1994a).

The DDE plasma concentrations detected in the Delaware Bay nestlings are similar to those reported for the inland Great Lakes region and generally lower than those reported for Maine, the Great Lakes shoreline, and the Columbia River estuary nestlings. The Delaware Bay DDE plasma levels do not appear to be significantly elevated, and can most likely be attributed to recent nestling exposure through diet.

3. Other Contaminants (Organic)

The measured concentrations of dieldrin and endrin were below concentrations reported for the Great Lakes area (Bowerman, 1991) and the Columbia River estuary (Anthony et al., 1993). The low levels detected in the Delaware Bay nestlings (maximum 22 ppb) were not considered to be of ecological significance.

4. Other Contaminants (Inorganic)

Whole blood mercury levels were extensively monitored in Maine nestlings in 1991 and 1992 (U.S. Fish and Wildlife Service, 1994a). Blood samples taken throughout Maine between 1991 and 1992 resulted in geometric mean mercury levels of 148 and 178 ppb, respectively. There were, however, significant differences in mercury exposure among habitat type. Nestlings from lake sites had the highest exposure (1991, 425 ppb; 1992, 553 ppb), followed by river sites (1991, 260 ppb; 1992, 253 ppb), estuary sites (1991, 119 ppb; 1992, 113 ppb), and marine sites (1991, 68 ppb; 1992, 94 ppb). The geometric mean concentration of mercury in blood of Delaware Bay nestlings (233 ppb) closely approximated the levels detected in Maine riverine habitats, and is clearly less than the inland lake regions of Maine. The Delaware Bay mercury levels were below the mean nestling whole blood concentration of 470 ppb reported for the Columbia River estuary (Anthony et al., 1993). However, direct comparison to the previous study results should be made with caution, as the Delaware Bay nestling mercury concentrations are reported for packed cells as opposed to whole blood. The implications of mercury concentrations in blood are not well understood, and neither Anthony et al. (1993) nor the U.S. Fish and Wildlife Service (1994a) has correlated mercury contamination with decreased productivity in bald eagles.

B. FEATHERS

The literature is fairly sparse concerning inorganic contaminant levels in bald eagle nestling feathers, and the ecological significance of detected concentrations is even less understood. However, mercury concentrations in eagle feathers have been reported for other areas of the country. The Delaware Bay concentrations were below the Maine geometric means of 6.6 ppm for 1991 and 7.8 ppm for 1992 (U.S. Fish and Wildlife Service, 1994a). The Delaware Bay concentrations were also lower than those found in the Great Lakes region between 1985 and 1989 (Bowerman et al., 1994b), and exceeded the geometric mean of 0.70 ppm reported for Louisiana (U.S. Fish and Wildlife Service, 1994b). The mean feather selenium concentration in the Delaware Bay eaglets exceeded the geometric mean of nearly 1.0 ppm reported for Louisiana (U.S. Fish and Wildlife Service, 1994b), and approximated the 1.9 ppm reported for the Great Lakes region between 1985 and 1989 (Bowerman et al., 1994b). The lead and cadmium feather concentrations in the Delaware Bay eaglets also exceeded those reported for Louisiana (U.S. Fish and Wildlife Service, 1994b). The biological significance of these contaminant concentrations in feathers remains unknown.

The Maine study found a significant correlation ($p<0.001$) between blood and feather mercury concentrations ($n = 98$, $r = 0.82$), which led the authors to conclude that feather mercury levels were an appropriate indicator of blood concentrations in nestlings. The lack of statistical significance in blood and feather inorganic concentration correlations in this investigation was due partly to the small sample sizes (twelve feather inorganic samples and eight blood inorganic samples). However, it is noteworthy that there was a suggestive trend of mercury blood and feather correlation in the Delaware Bay nestling data ($r = 0.567$, $p = 0.13$).

C. ADDLED EGG

1. PCBs

The total PCB concentration of over 28 ppm fresh weight in the New Jersey egg represents an elevated level of PCBs when compared to other study results from outside the Delaware Bay area. Total addled egg PCB mean concentrations were summarized in Bowerman et al. (1994a) for a variety of Great Lakes breeding areas and Alaska. The New Jersey total PCB concentration exceeded the geometric mean reported for Alaska (1.3 ppm), three Great Lakes interior breeding areas (5.0, 6.2, and 9.0 ppm), the Lake Superior and Lake Erie breeding areas (8.5 and 20.0 ppm, respectively), and was exceeded only by the Lake Michigan and Lake Huron breeding area geometric means (38 and 73 ppm, respectively) (Bowerman et al., 1994a). Addled bald eagle eggs collected in Maine in 1991 were found to contain a geometric mean concentration of 16.5 ppm adjusted wet weight (range 2.7 to 66.1 ppm) for a total of seven eggs (U.S. Fish and Wildlife Service, 1994a). A single bald eagle egg from coastal Louisiana contained 4.54 ppm total PCBs fresh weight (U.S. Fish and Wildlife Service, 1994b). Addled bald eagle eggs in Arizona collected from 1977 to 1985 contained a geometric mean PCB concentration of 1.1 ppm adjusted wet weight (range 0.29 - 8.5 ppm) (Grubb et al., 1990). Fresh bald eagle eggs recovered from nests in the Columbia River estuary contained a mean concentration of 12.7 ppm total PCBs (range 4.8 - 26.7 ppm) (Anthony et al., 1993).

Wiemeyer et al. (1984) reported an arithmetic mean PCB concentration of 29 ppm in addled bald eagle eggs that were collected in Delaware and Maryland from 1973 to 1979. Wiemeyer et al. (1984) concluded that PCB egg residues appeared fairly stable during the years studied in the Chesapeake Bay areas of Delaware, Maryland, and Virginia. The 1993 New Jersey egg PCB concentration of 28.1 ppm is not remarkable in terms of the relatively stable PCB concentrations found in the geographical area; however, the degree of decreased productivity resulting from PCBs and other contaminants remains unknown.

With only one egg analyzed in this study, it is impossible to determine its significance in terms of potential PCB-related reproductive effects in the Delaware Bay population, or for that matter, even for the nesting pair at the Raccoon Creek nest. However, the level of PCBs detected in the egg, combined with the fact that the embryo did not hatch, leads one to conclude that further nest monitoring at this location is imperative. It is noteworthy that there appeared to be no gross abnormalities in the unhatched chick that was dissected from the egg and subsequently analyzed.

2. DDT Metabolites

The concentration of DDD (2.65 ppm fresh weight) detected in the New Jersey eagle egg is significant. Addled bald eagle eggs collected from Maine in 1991 were found to contain a geometric mean concentration of 0.06 ppm fresh weight DDD (range 0.026 - 0.097 ppm) (U.S. Fish and Wildlife Service, 1994a). Addled bald eagle eggs in Arizona collected from 1977 to 1985 contained a geometric mean DDD concentration of 0.08 ppm fresh weight (range 0.04 - 0.14 ppm) (Grubb et al., 1990). Fresh bald eagle eggs collected from the Columbia River estuary contained a mean DDD concentration of 1.4 ppm (range 0.3 - 2.6 ppm) (Anthony et al., 1993). Wiemeyer et al. (1984) reported mean DDD residues from bald eagle eggs collected in Delaware and Maryland from 1973 to 1979 at 1.5 ppm. Wiemeyer et al. (1984) suggested that a decline in DDT and metabolites occurred in the Chesapeake Bay eagle eggs during the period from 1969 to 1979. Additional declines in eagle egg DDD levels were noted from 1980 to 1984 (Wiemeyer et al., 1993), which makes the concentration detected in the 1992 New Jersey egg even more significant.

The concentration of DDE (nearly 14 ppm fresh weight) detected in the New Jersey bald eagle egg is on the high end of the range for those reported for most areas in the country. Seven addled eagle eggs collected in Maine in 1991 contained a geometric mean concentration of 4.4 ppm adjusted wet weight DDE (range 1.0 to 10.9 ppm) (U.S. Fish and Wildlife Service, 1994a). The New Jersey DDE concentration exceeded the geometric mean reported for Alaska (0.5 ppm), three Great Lakes interior breeding areas (1.7, 1.8, and 2.2 ppm), the Lake Superior and Lake Erie breeding areas (3.2 and 2.8 ppm, respectively), and was exceeded only by the Lake Michigan and Lake Huron breeding area geometric means (17 and 16 ppm, respectively) (Bowerman et al., 1994a). The single bald eagle egg from coastal Louisiana contained DDE at 1.3 ppm fresh weight (U.S. Fish and Wildlife Service, 1994b). Addled bald eagle eggs in Arizona collected from 1977 to 1985 contained a geometric mean DDE concentration of 3.3 ppm adjusted wet weight (range 1.1 - 9.1 ppm) (Grubb et al., 1990). Fresh eggs recovered from nests in the Columbia River Estuary contained a mean DDE concentration of 9.7 ppm (range 4.0 - 20.0 ppm) (Anthony et al., 1993). Wiemeyer et al. (1984) reported an arithmetic mean DDE concentration of 16.4 ppm in addled bald eagle eggs that were collected in Delaware and Maryland from 1973 to 1979. Since decreasing trends in DDE concentrations in bald eagle eggs have been observed through 1984 (Wiemeyer et al., 1993), the level detected in the New Jersey egg is somewhat elevated for this geographical area.

Wiemeyer et al. (1984) predicted the percent eggshell thinning and rates of bald eagle reproduction (5-year average) as related to DDE concentrations in bald eagle eggs. Using the 3.3 ppm mean DDE concentration, Grubb et al. (1990) applied the regression equation in Wiemeyer et al. (1984) to predict eggshell thinning. The predicted result of 8.1 percent closely approximated the 8.8 percent measured result, and the authors concluded that this degree of moderate eggshell thinning did not appear to substantially adversely affect reproductive success. Applying the equation to the DDE concentration detected in the New Jersey egg results in a 13.3 percent eggshell thinning. The New Jersey egg was measured at 14.7 percent thin, which was fairly accurately predicted by the Wiemeyer et al. (1984) equation.

Wiemeyer et al. (1984) concluded that the bald eagle appeared to be less sensitive to DDE-induced eggshell thinning than the peregrine falcon and osprey. Their conclusion was based on evaluation of published peregrine falcon and osprey eggshell thinning verses DDE concentrations in the egg, and comparisons to the bald eagle data collected from 1969 to 1979. Steidl et al. (1991c) concluded that the nearly 20 percent eggshell thinning observed in New Jersey peregrine falcons did not appear to be responsible for geographical differences in productivity. Likewise, Steidl et al. (1991a) concluded that eggshell thinning (as related to DDE) did not appear to be the cause for decreased osprey reproduction along the Delaware Bay, and suggested that other more embryotoxic contaminants (certain PCBs) may have caused hatching failure.

Anthony et al. (1993) used the mean DDE concentration in eggs (9.7 ppm) and the Wiemeyer et al. (1984) equation to predict bald eagle productivity in the Columbia River estuary. The 0.38 young / occupied site result compared well to the 0.40 field measured productivity rate for the Washington side of the Columbia River. Conversely, Bowerman et al. (1994a) did not apply the Wiemeyer et al. (1984) equation because the high DDE concentrations found in the contaminated eggs of Lake Michigan and Lake Huron (maximum 41 ppm) would predict nearly zero productivity. Wiemeyer et al. (1993) later concluded that bald eagle young production was normal when eggs contained <3.6 ppm DDE, was nearly halved between 3.6 and 6.3 ppm, and was halved again at concentrations exceeding 6.3 ppm. Wiemeyer et al. (1993) also stated that relating DDE concentrations in eggs to productivity was only applicable to the breeding areas where the eggs were collected after failure to hatch, and warned that such breeding areas were not representative of all nesting bald eagles in the population.

Extrapolating productivity rates and percent eggshell thinning for the Delaware Bay bald eagle population from the DDE concentration in a single New Jersey addled egg is unwarranted. However, the DDD and DDE concentrations detected in the addled New Jersey egg were clearly elevated and may have contributed to the Raccoon Creek nest failure. The concentrations of DDD and DDE detected may indicate a local contaminant-related reproductive problem for the Raccoon Creek breeding pair.

3. Other Contaminants (Organic)

The fresh weight concentrations of dieldrin, chlordane, cis- and trans-nonachlor in the New Jersey egg were higher than those reported in Arizona collected eggs (Grubb et al., 1990). All pesticide concentrations except gamma-chlordane in the New Jersey egg equaled or exceeded the concentrations reported for the coastal Louisiana egg (U.S. Fish and Wildlife Service, 1994b). The New Jersey dieldrin concentration of 0.35 ppm exceeded the geometric mean reported for Alaska (0.01 ppm), three Great Lakes interior breeding areas (0.09, 0.13, and 0.13 ppm), and the Lake Superior breeding area (0.19 ppm). It was exceeded by the Lake Erie, Lake Michigan, and Lake Huron breeding area geometric means (0.45, 1.1, and 0.88 ppm, respectively) (Bowerman et al., 1994a). New Jersey egg concentrations of dieldrin, trans-nonachlor, and heptachlor epoxide were also higher than all seven Maine eggs collected in 1991 (U.S. Fish and Wildlife Service, 1994a). Concentrations of dieldrin, oxychlordane, trans-nonachlor, cis-nonachlor, and mirex in the New Jersey egg were well within the ranges previously reported in addled eagle eggs in Maryland and Delaware from 1969 to 1979 (Wiemeyer et al., 1984).

Bowerman et al. (1994a) concluded that addled egg concentrations of DDE, PCBs, and dieldrin were inversely correlated with bald eagle productivity; however, since these compounds were also highly inter-correlated among themselves, individual contaminant contributions could not be assessed. Thus, it is impossible to make any definitive statements regarding contaminant concentrations and their individual effects on Delaware Bay productivity. Furthermore, with only one egg analyzed in this investigation, it is unjustified to interpret data in terms of the breeding population. However, since a variety of pesticides in the New Jersey bald eagle egg are clearly higher than other areas in the country, further investigation is certainly warranted.

4. Other Contaminants (Inorganic)

Three of the five inorganic contaminants analyzed were detected in the New Jersey addled egg (lead, mercury, and selenium); however, all were detected at low concentrations. The mercury concentration of 0.075 ppm was below the means reported for Maine in 1991 (0.4 ppm; U.S. Fish and Wildlife Service, 1994a), Arizona (0.1 ppm; Grubb et al., 1990), the Columbia River estuary (0.2 ppm; Anthony et al., 1993), and Maryland and Delaware (0.8 ppm; Wiemeyer et al., 1984). The concentration of mercury was also well below the 0.5 ppm level implicated with reduced productivity in bald eagles (Wiemeyer et al., 1984 and 1993).

V. CONCLUSIONS / RECOMMENDATIONS

A. BLOOD

The blood analysis has clearly demonstrated that current nestling exposure to PBCs, DDE, dieldrin, and mercury has occurred. Concentrations of PCBs in the Delaware Bay nestlings were generally lower than those reported for Maine and the Great Lakes breeding areas, and were generally higher than those encountered in the Great Lakes inland breeding areas and the Pacific northwest. It remains unknown whether or not the PCB, DDE, and mercury blood levels detected have contributed to the low to moderate productivity observed in the Delaware Bay bald eagle population. Since bloodletting is an easy field technique, and it results in little additional stress to the nestling than that endured during routine banding, it should be strongly considered as a future biomonitoring tool in assessing local contribution of contaminants to bald eagles. The following recommendations are provided:

- o Specifically monitor the Raccoon Creek nest and collect blood from surviving eaglets in successive years for analysis. Congener specific PCB, pesticide, and mercury analysis, as well as the H4IIE bioassay procedure, should be performed with blood samples.
- o Generally, the Blackbird Creek and Stow Creek nestlings contained the highest blood levels of PCBs, DDD, DDE, and dieldrin. These nests should be given priority in future assessments.

B. FEATHERS

The baseline feather analysis conducted for the Delaware Bay bald eagle nestlings did not reveal any significant information regarding inorganic contamination, as the geometric mean concentrations were at or lower than those reported for other areas of the country. Furthermore, since mercury concentrations in bald eagle nestlings have been significantly correlated with breast feather concentrations (U.S. Fish and Wildlife Service, 1994a), no further feather analysis is recommended at this time.

C. ADDLED EGG

Concentrations of several contaminants (DDD, DDE, PCBs, dieldrin, cis- and trans-nonachlor, chlordane, and heptachlor epoxide) were elevated in the New Jersey egg when compared to bald eagle eggs analyzed throughout the country. Levels of DDD, DDE and total PCBs may have contributed to the nest failure (Wiemeyer et al., 1993). The following recommendation is provided:

- Continue to monitor all bald eagle nesting attempts in the Delaware Bay area and collect and analyze all addled eggs. Chemical analysis should include congener specific PCBs, pesticides, and mercury. Additionally, the H4IIE bioassay procedure should be performed on all eggs to elucidate potential toxicity of PCB congeners producing dioxin-related effects. Due to the minimal number of active nests in the Delaware Bay area, collection of fresh eggs for chemical analysis is not recommended.

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APPENDIX A

Analytical Results

Appendix A-1. Organic Contaminants in Bald Eagle Plasma (ppm wet weight), Delaware and New Jersey Nestlings, 1992-1993.

ANALYTE	SAMPLE IDENTIFICATION											
	APP92-1	APP92-2	APP93-1	BEA93-1	BEL92-1	BEL92-2	BLA92-1	BLA93-1	COH93-1	MUR93-1	STO92-1	STO93-1
HCB	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PCB-1242	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PCB-1248	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PCB-1254	0.059	nd	0.070	0.053	0.074	0.051	0.140	0.098	0.054	nd	nd	0.120
PCB-1260	0.089	0.084	0.084	nd	nd	nd	0.140	0.110	nd	nd	0.070	0.160
alpha BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
alpha Chlordane	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
beta BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
cis-Nonachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
delta BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dieldrin	nd	0.016	nd	nd	0.013	0.010	0.010	nd	nd	nd	0.022	0.010
Endrin	0.011	nd	nd	nd	nd	nd	nd	nd	0.010	nd	nd	nd
gamma BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
gamma Chlordane	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptachlor epoxide	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mirex	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
o,p'-DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
o,p'-DDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
o,p'-DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Oxychlordane	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
p,p'-DDD	0.014	0.013	0.016	nd	nd	nd	0.034	0.021	0.010	nd	0.010	0.025
p,p'-DDE	0.035	0.030	0.052	0.025	0.018	0.022	0.064	0.047	0.027	0.025	0.021	0.058
p,p'-DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Toxaphene	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
trans-Nonachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Percent Lipids	0.021	0.072	0.078	0.068	0.160	0.170	0.067	0.032	0.066	0.046	0.047	0.160

Appendix A-2. Inorganic Contaminants in Bald Eagle Packed Cells (ppm wet weight), Delaware and New Jersey Nestlings, 1992-1993.

ANALYTE	SAMPLE IDENTIFICATION							
	APP92-2	APP93-1	BEA93-1	BEL92-2	BLA93-1	COH93-1	MUR93-1	STO93-1
Arsenic	nd	nd	nd	0.090	nd	nd	nd	nd
Cadmium	nd	nd	nd	nd	nd	nd	nd	nd
Lead	0.090	0.100	0.130	0.100	0.100	0.130	0.090	0.060
Mercury	0.259	0.141	0.433	0.366	0.181	0.224	0.188	0.197
Selenium	0.650	0.530	0.680	0.910	0.560	0.700	0.520	0.420

EABLIN.XL

Appendix A-3. Inorganic Contaminants in Bald Eagle Feathers (ppm dry weight), Delaware and New Jersey Nestlings, 1992-1993.

ANALYTE	SAMPLE IDENTIFICATION											
	APP92-1	APP92-2	APP93-1	BEA93-1	BEL92-1	BEL92-2	BLA92-1	BLA93-1	COH93-1	MUR93-1	STO92-1	STO93-1
Arsenic	nd	nd	nd	0.26	0.21	0.21	0.37	nd	nd	nd	nd	nd
Cadmium	0.05	0.75	0.56	0.37	2.00	0.56	1.19	0.58	nd	0.97	2.04	0.60
Lead	5.23	7.56	6.08	3.74	9.08	1.61	17.10	3.90	1.80	7.76	9.01	2.09
Mercury	2.54	1.81	2.62	4.13	1.96	8.38	2.13	1.78	2.68	3.55	2.95	4.36
Selenium	1.87	2.03	2.40	0.85	1.01	1.19	1.60	1.04	1.43	12.10	1.20	1.77

EAFRIN.XL

APPENDIX B

Laboratory Raw Data and Quality Assurance Reports

U. S. FISH AND WILDLIFE SERVICE
PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE: 5040024 REGION: 5 REGIONAL ID: 5F14

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

HAZLETON LABORATORIES AMERICA, INC.
3301 KINSMAN BLVD.
MADISON, WISCONSIN 53704

AFTER A THOROUGH REVIEW OF THE REPORTS ISSUED BY THE LABORATORY, I REPORT THE FOLLOWING OBSERVATIONS AND CONCLUSIONS:

THE ACCURACY, AS MEASURED BY SPIKE RECOVERY AND REFERENCE MATERIAL ANALYSIS, WAS ACCEPTABLE FOR ALL ANALYTES.

THE PRECISION, AS MEASURED BY DUPLICATE SAMPLE ANALYSIS, WAS ACCEPTABLE.

WE HAVE NOT RECEIVED SUFFICIENT DATA FROM THIS LABORATORY TO ESTIMATE CONFIDENCE INTERVALS.

Eugene Cromartie 9/19/94

QUALITY ASSURANCE OFFICER DATE

ANALYTICAL INTEGRITY REPORT FORM

CATALOG: 50400024 REG. ID: 5F14 LAB HES

DATE	INITIALS	OK - PROBLEMS - ACTION TAKEN
4-14-94	Lin	INITIAL CHECK IN: electronic report
		required OK
4-19-94	EC	QA/QC Review - OK - See
		Quality Control Summary

CUSTOMIZED REPORT FOR USDI PATUXENT SAMPLES

PRINTED ON MON, APR 4, 1994 AT 10:26 AM

MATRIX ABBREVIATIONS:

ANIMAL TISSUE - AT
PLANT TISSUE - PT
WATER - WT
SOIL/SEDIMENT - SS

TOT VOL SLDS - TOTAL VOLATILE SOLIDS

ROUTE THIS REPORT TO USDI

Hazleton
Environmental
Services, Inc.

525 SCIENCE DRIVE • MADISON, WISCONSIN 53711

QUALITY CONTROL SUMMARY: PATUXENT ANALYTICAL CONTROL FACILITY

Catalog #: 5040024
Reg. ID #: 5F14
P.O. #: 85830-3-3228

Approved by:

John C. Walton (signature) 4/13/94
John C. Walton Date
Staff Scientist/Supervisor

	In Spec.	Out of Specification			
		Element	HLA LIMS #	Client ID	Comment
Blanks	✓				
Duplicates	✓				
Spikes	✓				
Reference Materials	✓				

General Comments:

1. Several of the samples were too small for moisture determination.
2. Selenium, arsenic, cadmium, and lead were determined by graphite furnace AAS.
3. Our lab samples "Cow BLOOD" and "LAB EGG" were used for QC.
4. a total of (21) samples were received.

Phone 608-232-3300 Fax 608-233-0502

Hazleton Environmental Services, Inc.

PATUXENT TOTAL SAMPLE WEIGHT

CATALOG # 3228

Lims #	Matrix	Sample Weight (g)	Sample ID
40100560	Animal Tissue	0.060	APP92-1C
40100561		1.618	APP92-2B
40100562		0.059	APP92-2C
40100563		2.074	APP93-1B
40100564		0.050	APP93-1C
40100565		1.969	BEA93-1B
40100566		0.129	BEA93-1C
40100567		0.142	BEL92-1C
40100568		0.944	BEL92-2B
40100569		0.114	BEL92-2C
40100570		0.081	BLA92-1C
40100571		1.749	BLA93-1B
40100572		0.096	BLA93-1C
40100573		2.005	COH93-1B
40100574		0.049	COH93-1C
40100575		1.991	MUR93-1B
40100576		0.068	MUR93-1C
40100577		21.315	RACC93-1
40100578		0.105	STO92-1C
40100579		0.796	STO93-1B
40100580		0.043	STO93-1C

HAZLETON LABORATORIES AMERICA, INC.
3301 Kinsman Blvd.
Madison, WI 53704
608-241-4471 x2393

EAsbLin. Tab

REPORT OF ANALYSIS

Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center
Laurel, MD 20708

Attn: John Moore
Analyte: % Moisture

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

	Sample ID	Matrix	Result %	LAB #
1.	APP92-1C	AT	.00	40100560
2.	APP92-2B	AT	.00	40100561
3.	APP92-2C	AT	.00	40100562
4.	APP93-1B	AT	.00	40100563
5.	APP93-1C	AT	.00	40100564
6.	BEA93-1B	AT	.00	40100565
7.	BEA93-1C	AT	.00	40100566
8.	BEL92-1C	AT	.00	40100567
9.	BEL92-2B	AT	.00	40100568
10.	BEL92-2C	AT	.00	40100569
11.	BLA92-1C	AT	.00	40100570
12.	BLA93-1B	AT	.00	40100571
13.	BLA93-1C	AT	.00	40100572
14.	COH93-1B	AT	.00	40100573
15.	COH93-1C	AT	.00	40100574
16.	MUR93-1B	AT	.00	40100575
17.	MUR93-1C	AT	.00	40100576
18.	RACC93-1	AT	78.80	40100577
19.	STO92-1C	AT	.00	40100578
20.	STO93-1B	AT	.00	40100579
21.	STO93-1C	AT	.00	40100580
22.	COWBLOOD	AT	78.70	40100585
23.	LABEGG	AT	76.80	40100586

HAZLETON LABORATORIES AMERICA, INC.
3301 Kinsman Blvd.
Madison, WI 53704
608-241-4471 x2393

REPORT OF ANALYSIS

Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center
Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: % Moisture Duplicate

	LAB #	Matrix	Result 1(%)	Result 2(%)	Average(%)	% RPD	Sample
1.	40100557	AT	76.80	76.70	76.75	.1	LABEGG
2.	40100582	AT	78.70	78.80	78.75	.1	COWBLOOD

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608-241-4471 x2393

REPORT OF ANALYSIS

Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center
Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: ARSENIC

	Sample ID	Matrix	ppm	(WET)	ppm	(DRY)	LOD ppm	LAB #
1.	APP92-1C	AT	<	.33	<	.33	.33	40100560
2.	APP92-2B	AT	<	.06	<	.06	.06	40100561
3.	APP92-2C	AT	<	.34	<	.34	.34	40100562
4.	APP93-1B	AT	<	.05	<	.05	.05	40100563
5.	APP93-1C	AT	<	.40	<	.40	.40	40100564
6.	BEA93-1B	AT	<	.06	<	.06	.06	40100565
7.	BEA93-1C	AT		.26		.26	.05	40100566
8.	BEL92-1C	AT		.21		.21	.05	40100567
9.	BEL92-2B	AT		.09		.09	.05	40100568
10.	BEL92-2C	AT		.21		.21	.05	40100569
11.	BLA92-1C	AT		.37		.37	.05	40100570
12.	BLA93-1B	AT	<	.05	<	.05	.05	40100571
13.	BLA93-1C	AT	<	.21	<	.21	.21	40100572
14.	COH93-1B	AT	<	.05	<	.05	.05	40100573
15.	COH93-1C	AT	<	.41	<	.41	.41	40100574
16.	MUR93-1B	AT	<	.05	<	.05	.05	40100575
17.	MUR93-1C	AT	<	.30	<	.30	.30	40100576
18.	RACC93-1	AT	<	.05	<	.24	.24	40100577
19.	STO92-1C	AT	<	.20	<	.20	.20	40100578
20.	STO93-1B	AT	<	.05	<	.05	.05	40100579
21.	STO93-1C	AT	<	.47	<	.47	.47	40100580
22.	COWBLOOD	AT	<	.05	<	.23	.23	40100585
23.	LABEGG	AT	<	.05	<	.22	.22	40100586

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REPORT OF ANALYSIS

Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center
Laurel, MD 20708

Catalog # 3220
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: ARSENIC   Blank

	LAB #	Result (mcg)		Detection Limit (mcg)
1.	40100556	<	.05	.05
2.	40100581	<	.05	.05

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Patuxent Analytical Control Facility
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Patuxent Wildlife Research Center
Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: ARSENIC   Duplicate

	LAB #	Matrix	Result 1(ppm)	Result 2(ppm)	Average(ppm)	% RPD	Sample
1.	40100557	AT	< .05	.74	NA	NA	LABEGG
2.	40100582	AT	< .05	< .05	NA	NA	COWBLOOD

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REPORT OF ANALYSIS

Patuxent Analytical Control Facility
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Patuxent Wildlife Research Center
Laurel, MD 20708

Attn: John Moore
Analyte: ARSENIC Spike

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

	LAB #	Matrix	Level (ppm)	Added (ppm)	Result (ppm)	% Recovery	Sample
1.	40100558	AT	< .05	9.80	9.74	99.39	LABEGG
2.	40100503	AT	< .05	9.26	8.56	92.44	COWBLOOD

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Patuxent Analytical Control Facility
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Patuxent Wildlife Research Center
Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: ARSENIC S.R.M.

	LAB #	Material	Cert. Value (ppm)	Result (ppm)	% Recovery
1.	40100559	NRCC DOLT-2	16.60	12.50	75.30
2.	40100584	NRCC DOLT-2	16.60	14.20	85.54

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: CADMIUM

	Sample ID	Matrix	ppm	(WET)	ppm	(DRY)	LOD ppm	LAB #
1.	APP92-1C	AT		.05		.05	.06	40100560
2.	APP92-2B	AT	<	.06	<	.06	.06	40100561
3.	APP92-2C	AT		.75		.75	.06	40100562
4.	APP93-1B	AT	<	.05	<	.05	.05	40100563
5.	APP93-1C	AT		.56		.56	.06	40100564
6.	BEA93-1B	AT	<	.06	<	.06	.06	40100565
7.	BEA93-1C	AT		.37		.37	.06	40100566
8.	BEL92-1C	AT		2.00		2.00	.06	40100567
9.	BEL92-2B	AT	<	.04	<	.04	.04	40100568
10.	BEL92-2C	AT		.56		.56	.06	40100569
11.	BLA92-1C	AT		1.19		1.19	.06	40100570
12.	BLA93-1B	AT	<	.05	<	.05	.05	40100571
13.	BLA93-1C	AT		.58		.58	.06	40100572
14.	CON93-1B	AT	<	.05	<	.05	.05	40100573
15.	CON93-1C	AT	<	.41	<	.41	.41	40100574
16.	MUR93-1B	AT	<	.05	<	.05	.05	40100575
17.	MUR93-1C	AT		.97		.97	.06	40100576
18.	RACC93-1	AT	<	.05	<	.24	.24	40100577
19.	STO92-1C	AT		2.04		2.04	.06	40100578
20.	STO93-1B	AT	<	.05	<	.05	.05	40100579
21.	STO93-1C	AT		.60		.60	.06	40100580
22.	COWBLOOD	AT	<	.05	<	.23	.23	40100585
23.	LABEGG	AT	<	.05	<	..22	.22	40100586

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Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: CADMIUM Blank

	LAB #	Result (mcg)		Detection Limit (mcg)
1.	40100556	<	.05	.05
2.	40100581	<	.05	.05

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Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: CADMIUM Duplicate

	LAB #	Matrix	Result 1(ppm)	Result 2(ppm)	Average(ppm)	% RPD	Sample
1.	40100557	AT	< .05	< .05	NA	NA	LABEGG
2.	40100582	AT	< .05	< .05	NA	NA	COWBLOOD

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: CADMIUM Spike

	LAB #	Matrix	Level (ppm)	Added (ppm)	Result (ppm)	% Recovery	Sample
1.	40100558	AT	< .05	9.80	9.01	91.94	LABEGG
2.	40100583	AT	< .05	9.26	8.10	87.47	COWBLOOD

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: CADMIUM S.R.M.

	LAB #	Material	Cert. Value (ppm)	Result (ppm)	% Recovery
1.	40100559	NRCC DOLT-2	20.80	20.10	96.63
2.	40100584	NRCC DOLT-2	20.80	19.80	95.19

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: LEAD

	Sample ID	Matrix	ppm (WET)	ppm (DRY)	LOD ppm	LAB #
1.	APP92-1C	AT	5.23	5.23	.10	40100560
2.	APP92-2B	AT	.09	.09	.10	40100561
3.	APP92-2C	AT	7.56	7.56	.10	40100562
4.	APP93-1B	AT	.10	.10	.10	40100563
5.	APP93-1C	AT	6.08	6.08	.10	40100564
6.	BEA93-1B	AT	.13	.13	.10	40100565
7.	BEA93-1C	AT	3.74	3.74	.10	40100566
8.	BEL92-1C	AT	9.08	9.08	.10	40100567
9.	BEL92-2B	AT	.10	.10	.10	40100568
10.	BEL92-2C	AT	1.61	1.61	.10	40100569
11.	BLA92-1C	AT	17.10	17.10	.10	40100570
12.	BLA93-1B	AT	.10	.10	.10	40100571
13.	BLA93-1C	AT	3.90	3.90	.10	40100572
14.	COH93-1B	AT	.13	.13	.10	40100573
15.	COH93-1C	AT	1.80	1.80	.10	40100574
16.	MUR93-1B	AT	.09	.09	.10	40100575
17.	MUR93-1C	AT	7.76	7.76	.10	40100576
18.	RACC93-1	AT	.07	.33	.47	40100577
19.	STO92-1C	AT	9.01	9.01	.10	40100578
20.	STO93-1B	AT	.06	.06	.10	40100579
21.	STO93-1C	AT	2.09	2.09	.10	40100580
22.	COWBLOOD	AT	.07	.33	.47	40100585
23.	LABEGG	AT	.07	.30	.43	40100586

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: LEAD Blank

	LAB #	Result (mcg)	Detection Limit (mcg)
1.	40100556	< .05	.05
2.	40100581	< .05	.05

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: LEAD Duplicate

	LAB #	Matrix	Result 1(ppm)	Result 2(ppm)	Average(ppm)	% RPD	Sample
1.	40100557	AT	.07	.06	.06	15.4	LABEGG
2.	40100582	AT	.07	.08	.08	13.3	COWBLOOD

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Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
·Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: LEAD Spike

LAB #	Matrix	Level (ppm)	Added (ppm)	Result (ppm)	% Recovery	Sample
1. 40100558	AT	.07	12.25	12.32	100.00	LABEGG
2. 40100583	AT	.07	11.57	12.21	104.93	COWBLOOD

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REPORT OF ANALYSIS

Patuxent Analytical Control Facility
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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: LEAD S.R.M.

	LAB #	Material	Cert. Value (ppm)	Result (ppm)	% Recovery
1.	40100559	NRCC DOLT-2	.22	.25	113.64
2.	40100584	NCRR DOLT-2	.22	.25	113.64

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REPORT OF ANALYSIS

Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center
Laurel, MD 20708

Attn: John Moore
Analyte: MERCURY

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

	Sample ID	Matrix	ppm (WET)	ppm (DRY)	LOD ppm	LAB #
1.	APP92-1C	AT	2.540	2.540	.010	40100560
2.	APP92-2B	AT	.259	.259	.010	40100561
3.	APP92-2C	AT	1.810	1.810	.010	40100562
4.	APP93-1B	AT	.141	.141	.010	40100563
5.	APP93-1C	AT	2.620	2.620	.010	40100564
6.	BEA93-1B	AT	.433	.433	.010	40100565
7.	BEA93-1C	AT	4.130	4.130	.010	40100566
8.	BEL92-1C	AT	1.960	1.960	.010	40100567
9.	BEL92-2B	AT	.366	.366	.010	40100568
10.	BEL92-2C	AT	8.380	8.380	.010	40100569
11.	BLA92-1C	AT	2.130	2.130	.010	40100570
12.	BLA93-1B	AT	.181	.181	.010	40100571
13.	BLA93-1C	AT	1.780	1.780	.010	40100572
14.	COH93-1B	AT	.224	.224	.010	40100573
15.	COH93-1C	AT	2.680	2.680	.010	40100574
16.	MUR93-1B	AT	.188	.188	.010	40100575
17.	MUR93-1C	AT	3.550	3.550	.010	40100576
18.	RACC93-1	AT	.141	.665	.047	40100577
19.	STO92-1C	AT	2.950	2.950	.010	40100578
20.	STO93-1B	AT	.197	.197	.010	40100579
21.	STO93-1C	AT	4.360	4.360	.010	40100580
22.	COWBLOOD	AT	< .010	< .047	.047	40100585
23.	LABEGG	AT	.011	.047	.043	40100586

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REPORT OF ANALYSIS

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Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: MERCURY   Blank

	LAB #	Result (mcg)	Detection Limit (mcg)
1.	40100556	< .010	.010
2.	40100581	< .010	.010

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Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: MERCURY   Duplicate

	LAB #	Matrix	Result 1(ppm)	Result 2(ppm)	Average(ppm)	% RPD	Sample
1.	40100557	AT	.011	< .010	NA	NA	LABEGG
2.	40100582	AT	< .010	.013	NA	NA	COWBLOOD

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Laurel, MD 20708

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: MERCURY Spike

	LAB #	Matrix	Level (ppm)	Added (ppm)	Result (ppm)	% Recovery	Sample
1.	40100558	AT	.011	.048	.049	79.167	LABEGG
2.	40100583	AT	< .010	.050	.053	106.000	COWBLOOD

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: MERCURY S.R.M.

	LAB #	Material	Cert. Value (ppm)	Result (ppm)	% Recovery
1.	40100559	NRCC DORM-1	.798	.822	103.01
2.	40100584	NRCC DORM-1	.798	.895	112.15

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Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: SELENIUM

	Sample ID	Matrix	ppm (WET)	ppm (DRY)	LOD ppm	LAB #
1.	APP92-1C	AT	1.87	1.87	.10	40100560
2.	APP92-2B	AT	.65	.65	.10	40100561
3.	APP92-2C	AT	2.03	2.03	.10	40100562
4.	APP93-1B	AT	.53	.53	.10	40100563
5.	APP93-1C	AT	2.40	2.40	.10	40100564
6.	BEA93-1B	AT	.68	.68	.10	40100565
7.	BEA93-1C	AT	.85	.85	.10	40100566
8.	BEL92-1C	AT	1.01	1.01	.10	40100567
9.	BEL92-2B	AT	.91	.91	.10	40100568
10.	BEL92-2C	AT	1.19	1.19	.10	40100569
11.	BLA92-1C	AT	1.60	1.60	.10	40100570
12.	BLA93-1B	AT	.56	.56	.10	40100571
13.	BLA93-1C	AT	1.04	1.04	.10	40100572
14.	COH93-1B	AT	.70	.70	.10	40100573
15.	COH93-1C	AT	1.43	1.43	.10	40100574
16.	MUR93-1B	AT	.52	.52	.10	40100575
17.	MUR93-1C	AT	12.10	12.10	.10	40100576
18.	RACC93-1	AT	.46	2.17	.47	40100577
19.	STO92-1C	AT	1.20	1.20	.10	40100578
20.	STO93-1B	AT	.42	.42	.10	40100579
21.	STO93-1C	AT	1.77	1.77	.10	40100580
22.	COWBLOOD	AT	.16	.75	.47	40100585
23.	LABEGG	AT	.19	.82	.43	40100586

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Laurel, MD 20708

Attn: John Moore
Analyte: SELENIUM Blank

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

	LAB #	Result (mcg)	Detection Limit (mcg)
1.	40100556	< .05	.05
2.	40100581	< .05	.05

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Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: SELENIUM Duplicate

	LAB #	Matrix	Result 1(ppm)	Result 2(ppm)	Average(ppm)	% RPD	Sample
1.	40100557	AT	.19	.21	.20	10.0	LABEGG
2.	40100582	AT	.16	.14	.15	13.3	COWBLOOD

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Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

Attn: John Moore
Analyte: SELENIUM   Spike

	LAB #	Matrix	Level (ppm)	Added (ppm)	Result (ppm)	% Recovery	Sample
1.	40100558	AT	.19	9.80	9.75	97.55	LABEGG
2.	40100583	AT	.16	9.26	8.22	87.04	COWBLOOD

HAZLETON LABORATORIES AMERICA, INC.
3301 Kinsman Blvd.
Madison, WI 53704
608-241-4471 x2393

REPORT OF ANALYSIS

Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center -
Laurel, MD 20708

Attn: John Moore
Analyte: SELENIUM S.R.M.

Catalog # 3228
Purchase Order # 85830-3-3228
Batch # #: 5040024
Contract # 14-16-0009-87-007
Date Entered: 01/24/94
Date Printed: 04/04/94

	LAB #	Material	Cert. Value (ppm)	Result (ppm)	% Recovery
1.	40100559	NRCC DOLT-2	6.06	5.21	85.97
2.	40100584	NRCC DOLT-2	6.06	6.10	100.66

ECDMS ANALYTICAL REPORT (6)

06-Dec-93

Catalog: 5040024 | Regional Study Id: 5F14 | Purchase Order: 85830-3-3359

User Id: R5NJFO | Submitter: Craig Moore - Pleasantville, NJ

Lab Name: Mississippi State Chemical Laboratory (MSCL)

Report Includes the Following Sections:

- Weight, % Moisture, % Lipid, Total Suspended Solids
- Soil / Sediment Parameters
- Contaminant Concentrations
- Procedural Blanks
- Duplicates
- Reference Materials
- Spike Recoveries
- Comments (Result Modifers and QA/QC Comments)
- Analytical Methods

Key this FORM

WEIGHT, % MOISTURE, % LIPID, TOTAL SUSPENDED SOLIDS

Sample Number	Sample Matrix	Sample Weight (g)	Percent Moisture	Percent Lipid	Total Suspended Solids (%)
RACC93-1	Avian Egg	63.7	79.2	4.1	
APP92-1a	Serum	5.02		.021	
APP92-2a	Serum	6.51		.072	
APP93-1a	Serum	5.79		.078	
BEA93-1a	Serum	5.31		.068	
BEL92-1a	Serum	6.24		.16	
BEL92-2a	Serum	6.56		.17	
BLA92-1a	Serum	6.04		.067	
BLA93-1a	Serum	5.28		.032	
COH93-1a	Serum	5.19		.066	
MUR93-1a	Serum	4.81		.046	
STO92-1a	Serum	5.27		.047	
STO93-1a	Serum	6.15		.16	

SOIL / SEDIMENT PARAMETERS

Sample Number	Percent TVS	Percent TOC	Particle Size %Sand	Particle Size %Silt	Particle Size %Clay

- NO DATA EXIST FOR THIS SECTION.

CONTAMINANT CONCENTRATIONS

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
HCB	RACC93-1	Avian Egg	.1826923	.0480769	.038	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
PCB-1242	RACC93-1	Avian Egg	< .2403846	.2403846	< .05	.05
	APP92-1a	Serum			< .05	.05
	APP92-2a	Serum			< .05	.05
	APP93-1a	Serum			< .05	.05
	BEA93-1a	Serum			< .05	.05
	BEL92-1a	Serum			< .05	.05
	BEL92-2a	Serum			< .05	.05
	BLA92-1a	Serum			< .05	.05
	BLA93-1a	Serum			< .05	.05
	COH93-1a	Serum			< .05	.05
	MUR93-1a	Serum			< .05	.05
	STO92-1a	Serum			< .05	.05
	STO93-1a	Serum			< .05	.05
PCB-1248	RACC93-1	Avian Egg	< .2403846	.2403846	< .05	.05
	APP92-1a	Serum			< .05	.05
	APP92-2a	Serum			< .05	.05
	APP93-1a	Serum			< .05	.05
	BEA93-1a	Serum			< .05	.05
	BEL92-1a	Serum			< .05	.05

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
PCB-1248	BEL92-2a	Serum			< .05	.05
	BLA92-1a	Serum			< .05	.05
	BLA93-1a	Serum			< .05	.05
	COH93-1a	Serum			< .05	.05
	MUR93-1a	Serum			< .05	.05
	STO92-1a	Serum			< .05	.05
	STO93-1a	Serum			< .05	.05
PCB-1254	RACC93-1	Avian Egg	115.3846154	.2403846	24	.05
	APP92-1a	Serum			.059	.05
	APP92-2a	Serum			< .05	.05
	APP93-1a	Serum			.07	.05
	BEA93-1a	Serum			.053	.05
	BEL92-1a	Serum			.074	.05
	BEL92-2a	Serum			.051	.05
	BLA92-1a	Serum			.14	.05
	BLA93-1a	Serum			.098	.05
	COH93-1a	Serum			.054	.05
	MUR93-1a	Serum			< .05	.05
	STO92-1a	Serum			< .05	.05
	STO93-1a	Serum			.12	.05
PCB-1260	RACC93-1	Avian Egg	139.4230769	.2403846	29	.05
	APP92-1a	Serum			.089	.05
	APP92-2a	Serum			.084	.05
	APP93-1a	Serum			.084	.05
	BEA93-1a	Serum			< .05	.05
	BEL92-1a	Serum			< .05	.05
	BEL92-2a	Serum			< .05	.05
	BLA92-1a	Serum			.14	.05
	BLA93-1a	Serum			.11	.05
	COH93-1a	Serum			< .05	.05
	MUR93-1a	Serum			< .05	.05
	STO92-1a	Serum			.07	.05
	STO93-1a	Serum			.16	.05

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
alpha BHC	RACC93-1	Avian Egg	< .0480769	.0480769	< .01	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
alpha chlordane	RACC93-1	Avian Egg	4.8076923	.0480769	1	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
beta BHC	RACC93-1	Avian Egg	.2307692	.0480769	.048	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
beta BHC	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
cis-nonachlor	RACC93-1	Avian Egg	2.0673077	.0480769	.43	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
delta BHC	RACC93-1	Avian Egg	< .0480769	.0480769	< .01	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
dieldrin	RACC93-1	Avian Egg	3.1730769	.0480769	.66	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			.016	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			.013	.01
	BEL92-2a	Serum			.01	.01
	BLA92-1a	Serum			.01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			.022	.01
	STO93-1a	Serum			.01	.01
endrin	RACC93-1	Avian Egg	< .0480769	.0480769	< .01	.01
	APP92-1a	Serum			.011	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			.01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
gamma BHC	RACC93-1	Avian Egg	.2692308	.0480769	.056	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
gamma BHC	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
gamma chlordane	RACC93-1	Avian Egg	< .0480769	.0480769	< .01	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
heptachlor epoxide	RACC93-1	Avian Egg	1.1538462	.0480769	.24	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
mirex	RACC93-1	Avian Egg	.2884615	.0480769	.06	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
o,p'-DDD	RACC93-1	Avian Egg	< .0480769	.0480769	< .01	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
o,p'-DDE	RACC93-1	Avian Egg	1.3461538	.0480769	.28	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
o,p'-DDE	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
o,p'-DDT	RACC93-1	Avian Egg	< .0480769	.0480769	< .01	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
oxychlordane	RACC93-1	Avian Egg	.9615385	.0480769	.2	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
p,p'-DDD	RACC93-1	Avian Egg	24.0384615	.0480769	5	.01
	APP92-1a	Serum			.014	.01
	APP92-2a	Serum			.013	.01
	APP93-1a	Serum			.016	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			.034	.01
	BLA93-1a	Serum			.021	.01
	COH93-1a	Serum			.01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			.01	.01
	STO93-1a	Serum			.025	.01
p,p'-DDE	RACC93-1	Avian Egg	125	.0480769	26	.01
	APP92-1a	Serum			.035	.01
	APP92-2a	Serum			.03	.01
	APP93-1a	Serum			.052	.01
	BEA93-1a	Serum			.025	.01
	BEL92-1a	Serum			.018	.01
	BEL92-2a	Serum			.022	.01
	BLA92-1a	Serum			.064	.01
	BLA93-1a	Serum			.047	.01
	COH93-1a	Serum			.027	.01
	MUR93-1a	Serum			.025	.01
	STO92-1a	Serum			.021	.01
	STO93-1a	Serum			.058	.01
p,p'-DDT	RACC93-1	Avian Egg	.2884615	.0480769	.06	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01

CONTAMINANT CONCENTRATIONS (Cont.)

Analyte	Sample Number	Sample Matrix	Result (ppm Dry Wt.)	Detection Limit (ppm Dry Wt.)	Result (ppm Wet Wt.)	Detection Limit (ppm Wet Wt.)
p,p'-DDT	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01
toxaphene	RACC93-1	Avian Egg	< .2403846	.2403846	< .05	.05
	APP92-1a	Serum			< .05	.05
	APP92-2a	Serum			< .05	.05
	APP93-1a	Serum			< .05	.05
	BEA93-1a	Serum			< .05	.05
	BEL92-1a	Serum			< .05	.05
	BEL92-2a	Serum			< .05	.05
	BLA92-1a	Serum			< .05	.05
	BLA93-1a	Serum			< .05	.05
	COH93-1a	Serum			< .05	.05
	MUR93-1a	Serum			< .05	.05
	STO92-1a	Serum			< .05	.05
	STO93-1a	Serum			< .05	.05
trans-nonachlor	RACC93-1	Avian Egg	6.7307692	.0480769	1.4	.01
	APP92-1a	Serum			< .01	.01
	APP92-2a	Serum			< .01	.01
	APP93-1a	Serum			< .01	.01
	BEA93-1a	Serum			< .01	.01
	BEL92-1a	Serum			< .01	.01
	BEL92-2a	Serum			< .01	.01
	BLA92-1a	Serum			< .01	.01
	BLA93-1a	Serum			< .01	.01
	COH93-1a	Serum			< .01	.01
	MUR93-1a	Serum			< .01	.01
	STO92-1a	Serum			< .01	.01
	STO93-1a	Serum			< .01	.01

PROCEDURAL BLANKS

Analyte	Lab Sample Number	Result Total UG
HCB	855959	0
PCB-1242	855959	0
PCB-1248	855959	0
PCB-1254	855959	0
PCB-1260	855959	0
alpha BHC	855959	0
alpha chlordane	855959	0
beta BHC	855959	0
cis-nonachlor	855959	0
delta BHC	855959	0
dieldrin	855959	0
endrin	855959	0
gamma BHC	855959	0
gamma chlordane	855959	0
heptachlor epoxide	855959	0
mirex	855959	0
o,p'-DDD	855959	0
o,p'-DDE	855959	0

PROCEDURAL BLANKS (Cont.)

Analyte	Lab Sample Number	Result Total UG
o,p'-DDT	855959	0
oxychlordane	855959	0
p,p'-DDD	855959	0
p,p'-DDE	855959	0
p,p'-DDT	855959	0
toxaphene	855959	0
trans-nonachlor	855959	0

DUPLICATES

Analyte	Sample Number	Sample Matrix	Initial Result (ppm / %)	Duplicate Result (ppm / %)	Average	Relative % Difference
% Lipid	BEL92-2a	Serum	.17 %	.2 %	0.185	16.22
HCB	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
PCB-1242	BEL92-2a	Serum	< .05 Wet	< .05 Wet	0.025	0
PCB-1248	BEL92-2a	Serum	< .05 Wet	< .05 Wet	0.025	0
PCB-1254	BEL92-2a	Serum	.051 Wet	< .05 Wet	0.038	68.42
PCB-1260	BEL92-2a	Serum	< .05 Wet	< .05 Wet	0.025	0
alpha BHC	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
alpha chlordane	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
beta BHC	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
cis-nonachlor	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
delta BHC	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
dieldrin	BEL92-2a	Serum	.01 Wet	.012 Wet	0.011	18.18
endrin	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
gamma BHC	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
gamma chlordane	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
heptachlor epoxide	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
mirex	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0

DUPLICATES (Cont.)

Analyte	Sample Number	Sample Matrix	Initial Result (ppm / %)	Duplicate Result (ppm / %)	Average	Relative % Difference
o,p'-DDD	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
o,p'-DDE	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
o,p'-DDT	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
oxychlordane	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
p,p'-DDD	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
p,p'-DDE	BEL92-2a	Serum	.022 Wet	.024 Wet	0.023	8.7
p,p'-DDT	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0
toxaphene	BEL92-2a	Serum	< .05 Wet	< .05 Wet	0.025	0
trans-nonachlor	BEL92-2a	Serum	< .01 Wet	< .01 Wet	0.005	0

REFERENCE MATERIALS

Analyte	Lab Sample Number	S.R.M. ID	S.R.M. Name	* Certified Reference Value (ppm / %)	95% Confidence Interval	Result (ppm / %)	Percent Recovery

- NO DATA EXIST FOR THIS SECTION.

SPIKE RECOVERIES

Analyte	Sample Number	Sample Matrix	Spike Level (ppm / %)	Amount Recovered (ppm / %)	* Spike / Background	Percent Recovery
HCB	ST093-1a	Serum	.2 Wet	0.12 Wet	20	60
PCB-1254	ST093-1a	Serum	2 Wet	1.38 Wet	16.67	69
PCB-1260	ST093-1a	Serum	2 Wet	1.94 Wet	12.5	97
alpha chlordane	ST093-1a	Serum	.2 Wet	0.16 Wet	20	80
beta BHC	ST093-1a	Serum	.2 Wet	0.18 Wet	20	90
cis-nonachlor	ST093-1a	Serum	.2 Wet	0.16 Wet	20	80
dieldrin	ST093-1a	Serum	.2 Wet	0.15 Wet	20	75
endrin	ST093-1a	Serum	.2 Wet	0.15 Wet	20	75
gamma BHC	ST093-1a	Serum	.2 Wet	0.18 Wet	20	90
heptachlor epoxide	ST093-1a	Serum	.2 Wet	0.19 Wet	20	95
mirex	ST093-1a	Serum	.2 Wet	0.17 Wet	20	85
o,p'-DDE	ST093-1a	Serum	.2 Wet	0.17 Wet	20	85
o,p'-DDT	ST093-1a	Serum	.2 Wet	0.17 Wet	20	85
oxychlordane	ST093-1a	Serum	.2 Wet	0.18 Wet	20	90
p,p'-DDD	ST093-1a	Serum	.2 Wet	0.185 Wet	8	92.5
p,p'-DDE	ST093-1a	Serum	.2 Wet	0.182 Wet	3.45	91

* For a spike to be a valid measure of method accuracy, this ratio must be higher than 1.0.

SPIKE RECOVERIES (Cont.)

Analyte	Sample Number	Sample Matrix	Spike Level (ppm / %)	Amount Recovered (ppm / %)	* Spike / Background	Percent Recovery
p,p'-DDT	ST093-1a	Serum	.2 Wet	0.17 Wet	20	85
trans-nonachlor	ST093-1a	Serum	.2 Wet	0.19 Wet	20	95

* For a spike to be a valid measure of method accuracy, this ratio must be higher than 1.0.

COMMENTS (RESULT MODIFERS AND QA/QC COMMENTS)

Analyte	Sample Number	Result Modifier
PCB-1254	RACC93-1	Confirmed by GC/Mass Spectrometry
PCB-1260	RACC93-1	Confirmed by GC/Mass Spectrometry
alpha chlordane	RACC93-1	Confirmed by GC/Mass Spectrometry
cis-nonachlor	RACC93-1	Confirmed by GC/Mass Spectrometry
dieldrin	RACC93-1	Confirmed by GC/Mass Spectrometry
heptachlor epoxide	RACC93-1	Confirmed by GC/Mass Spectrometry
o,p'-DDE	RACC93-1	Confirmed by GC/Mass Spectrometry
oxychlordane	RACC93-1	Confirmed by GC/Mass Spectrometry
p,p'-DDD	RACC93-1	Confirmed by GC/Mass Spectrometry
p,p'-DDE	RACC93-1	Confirmed by GC/Mass Spectrometry
trans-nonachlor	RACC93-1	Confirmed by GC/Mass Spectrometry

* Result Modifier 'M' = Compound identiy was confirmed by GC/MS.

QA/QC Comments
APPROVED, CSH

ANALYTICAL METHODS

Method Code	Method Description
011	LABORATORY: Mississippi State Chemical Laboratory

Analysis for Organochlorine Pesticides and PCBs in Blood Serum, Plasma or Whole Blood

XI. Reference: Manual of Analytical Methods for the Analysis of Pesticides in Humans and Enviromental Samples, Section 5, A, (3), (a)

Modified as follows;

A 2-ml aliquot of serum, Plasma or whole blood, is extracted with 6 ml of hexane in a 16 X 125 mm screw-capped(teflon liner) culture tube. The extraction is conducted for 2 hours at 50 RPM on a rotating mixer. Alternatively, the extraction may be accomplished by vigorous mixing on a vortex mixer for 2 minutes. The formation of emulsion is unlikely, but if it should occur, centrifugation may be used to effect separation of the layers. In most instances, quantification by ec/gc can be performed on the hexane extract without further treatment; otherwise a suitable aliquot of the hexane layer may be quantitatively transferred to an evaporative concentrator tube to which is affixed a modified micro-Snyder column. The extract is concentrated in a water or steam bath, and the final volume is adjusted to correspond to the expected concentration of the pesticide residue. A suitable aliquot is analyzed by electron capture gas chromatography.

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