

BIOTA REMEDIAL INVESTIGATION AND COMPREHENSIVE MONITORING PROGRAM
SUMMARY

This report summarizes the results of the Army's wildlife tissue sampling collected as part of the Remedial Investigation (RI) and the Comprehensive Monitoring Program (CMP) for 1988 and 1989. The objective of the Army's RI program was to assess the Rocky Mountain Arsenal's (RMA) contamination in relation to biota. The CMP program was designed to provide continued and long-term monitoring of contaminants in biota. Several concerns exist regarding the adequacy of the CMP and RI investigations, including the Army's minimal number of contaminant compounds, or target analytes, tested for in the biota substrate and the very limited number of samples for individual biota species.

Although the target analytes were limited to seven, and the sample sizes are small, the results show a very consistent pattern of contamination in the aquatic environment and a moderately consistent pattern in the terrestrial. In general, aquatic species principally showed mercury and dieldrin contamination and a minor presence of DDE. Terrestrial species showed dieldrin as a ubiquitous contaminant that was clearly being magnified in the higher trophic levels. Arsenic, mercury, and DDE were present to a lesser degree and did not appear to be undergoing magnification. It remains uncertain whether additional compounds, i.e.; nontarget compounds, exist in significant concentrations since they were not included in either program. Investigations implemented prior to the RI identified several additional contaminants in the tissue of RMA wildlife. In addition, because of the small sample sizes of numerous species of RMA biota, summarizing species-specific contamination may be unreliable.

In order to compare contaminant concentrations of RMA biota with biota believed to be unexposed to RMA contamination, the Army established contamination values in what are described as control areas. In some cases control sites were established many miles from RMA, in other cases control samples were taken from areas within the RMA that at one time were believed to be relatively uncontaminated (the SE corner of RMA for example). Later surficial soils sampling identified these on-site areas as being slightly to moderately contaminated. Tissue concentrations of the control samples taken off the RMA were generally below detection limits. The off-site exception was mallard ducks for which half the samples showed mercury and DDE contamination. The on-site controls ranked midway between the off-site controls and the on-site RI and CMP results with detections less frequent and the ranges lower than the other on-site samples. The earthworms from the control area in section 5 (southeast corner of RMA) were an exception, all the composited samples tested positive for arsenic and one showed high levels of dieldrin. Given that any dieldrin detections in RMA biota can only be attributed to Army/Shell activities (since this compound is not naturally occurring) the on-site controls were not representative of

unexposed biota and, therefore, detailed results from controls have not been included in this report.

RI and CMP Results

Dieldrin is the prominent contaminant found in the terrestrial biotic environment with virtually every species having at least one positive dieldrin detection. As might be expected, concentrations of dieldrin were highest in those burrowing animals which live in the vicinity of the South Plants and waste storage basins.

The RI study reported every prairie dog collected in Section 36 (a total of 14 samples) as having some level of dieldrin contamination. Concentrations ranged from 0.119 ppm to 13.4 ppm. Because prairie dogs constitute a major food resource for bald eagles at RMA, in 1989 the Army initiated an extermination program for those animals in Section 36 to prevent their contamination from passing to the federally protected bald eagles. This extermination eliminated roughly 15% of the RMA's prairie dog population.

Table 1, Results of the Biota RI Terrestrial Sampling Program, was compiled from the 1989 Army document. This information includes results for animals which were found dead on RMA as well as ones captured and sampled.

One of the more striking results from the RI was the level of organochlorine pesticides (OCPs) in the brains of dead raptors. Of 14 birds collected, 10 had measurable dieldrin in their brains with concentrations ranging from .175 to 15.6 ppm. The cause of death for these animals was not established; however, dieldrin-brain concentrations of 5 ppm are cited in the RI (pg 5-155) as being lethal, indicating that direct toxic effects are very possible. Of 10 juvenile kestrels collected alive from nests across RMA, 6 had measurable dieldrin with mean body concentrations of .316 ppm. The results of the 1988 CMP program for Kestrels support these RI results. Out of 5 kestrel juvenile carcasses sampled, all tested positive for dieldrin. The maximum carcass concentration was 1.80 ppm and the mean was 0.921 ppm.

Of the various "fortuitous samples" (dead or dying animals which are taken outside any regular RI or CMP sampling program) the highest recorded dieldrin concentration was found in a dead mourning dove discovered outside Building 111. The concentration of dieldrin in this animal's carcass was 56.3 ppm. Other OCPs were present as well. This concentration is well above the level currently proposed as the Maximum Allowable Tissue Concentration (MATissueC) (1.6 ppm). It should be noted that this MATissueC has been challenged by EPA, U.S. Fish and Wildlife and the State as being too high. Since that sample was identified, the U.S. add

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Fish and Wildlife Service has been concerned with frequent discoveries of dead birds (7-8 per week) adjacent to Building 111. The reason for their deaths has not been identified. add

Dieldrin was also found at elevated concentrations in higher trophic levels. A coyote that was found dead had a liver concentration of 7.6 ppm dieldrin and the liver of a badger found dead had 1.64 ppm. Reference material obtained by the Army states that, for small mammals, studies reported "values above RRV (4 ppm) (are) lethal". While not conclusive, it must be regarded as entirely possible that the death of these animals was influenced by dieldrin poisoning.

Arsenic was found in the lower trophic levels, but did not show up at elevated levels in the carnivores. DDT/DDE occurred most prominently in waterfowl with mallard samples showing concentrations ranging from .094 to .507 ppm. Prairie dogs in Section 36 tested positive for mercury.

Mammals showed two contaminant trends. Deer and rabbits (herbivores with relatively little soil contact) were comparatively uncontaminated, although the deer sample size was too small to characterize contaminant trends accurately. Prairie dogs displayed heavy contamination indicating that direct contaminant uptake from the soil is an important exposure pathway for that species. If plants alone could supply that level of contamination, one would expect to find it in other mammalian herbivores.

Table 2, "Results from the Biota RI Aquatic Sampling Program" was also taken directly from the 1989 Army report. This table shows two principal chemicals of concern in aquatic RMA ecosystems; dieldrin and mercury. This is not surprising in that these two compounds comprise most of the water/sediment contamination in the RMA lakes. DDE was found in Lake Derby and is evidently magnifying in fish, but is not as ubiquitous as the other two compounds.

Table 3, "1988 and 1989 Terrestrial Biota CMP Results" summarizes the Army's efforts to characterize contamination by trophic level. The first number in each column gives the number of positive detections, the second number gives the total sample size. The column labeled "% in trophic level" gives the percentage of total positive detections divided by the total sample size. This column gives an indication of the prevalence of contamination in the entire trophic level. The CMP programs show trends similar to those found in the RI. Detections for all 7 target analytes were found in the lower terrestrial trophic levels, but only dieldrin was consistently reported in higher trophic levels.

Table 4, "1988 and 1989 Aquatic Biota CMP Results" shows arsenic elevated in lower trophic levels but not magnified in the higher levels. Dieldrin, mercury, and DDE were the contaminants found most consistently in the carnivorous fish at the top of the food chain.

Toxicity of the Target Analytes

Most studies of chemical toxicity measure doses which are administered to subject animals under controlled laboratory conditions. The Army's ecological risk assessment, however, proposes an unproven methodology which establishes "acceptable" tissue concentrations (MATissueC). Tissue concentrations above these levels are associated with toxic effects. The Army's method of toxicity evaluation has undergone a lengthy evaluation by the EPA, Shell and the State. Each of the Parties has identified several concerns with the method. The State has concluded that the Army's MATissueC methodology may not provide adequate protection to the RMA wildlife and therefore should be abandoned in favor of a more traditional dose/response analysis similar to that used in human risk assessment. EPA and Shell have objected to various components of the food web model exercise; however, they have not rejected the conceptual framework. Details of review are beyond the scope of this memo, but could be shared with anyone interested.

The following table summarizes the Reasonable Representative Values (RRV) of the Army's MATissueC parameter packet. These values do not reflect any consistent toxicological endpoint and have been based on studies which had results that range from No Observed Effects Limits to Lethality. It is fair to say there is little consensus among the Parties that they are either "Reasonable" or "Representative". Nevertheless, these draft MATissueC numbers may serve as a starting point for interpretation of the tissue concentration results. Values refer to the mean wet weight body tissue concentrations in parts per million (ppm) - as is the case throughout this report unless otherwise specified.

Maximum Allowable Tissue Concentrations (MATissueC ppm).
Reasonable Representative Values from Offpost EA

	ALD/Dield	DDT/DDE	Endrin	Arsenic	Mercury
Eagle	1.6	2	0.01	----	0.36
Water Bird	1.6	2	1.9	----	0.36
Large Fish	---	---	---	N/A	.47
Small Fish	---	---	---	N/A	.67
Small Bird	1.6	2	0.450	---	.36
Small Mammals	3.75	3.3	---	N/A	45
Medium Mammal	3.75	3.3	45	N/A	---
Heron	1.6	2	0.01	---	0.36

Amphibians	----	----	---	---	N/A
Owl	1.6	2	0.01	---	0.36
Kestrel	1.6	2	0.01	---	0.36
Shore Bird	1.6	2	N/A	---	0.36

NA = Not Available

Conclusions

The Army's RI and CMP programs indicate that RMA biota have varying degrees of contaminant levels. It appears that those terrestrial species with habitats closely associated with exposure to soils (ie: burrowing animals, invertebrates and small mammals and rodents) are most likely to contain elevated levels of RMA related contamination. With a few exceptions, the farther you move away from the center of RMA, generally the most highly contaminated, the less concentrated the contamination is in the substrate of terrestrial RMA biota.

The primary target analyte detected in the RMA terrestrial biota is dieldrin. This is expected due to the fact that the pesticide is widely distributed throughout the RMA surface and subsurface soils and is known to bioaccumulate in the tissue of animals. All of the remaining target analytes have been detected in RMA terrestrial biota, but not to the extent of dieldrin. There may be other compounds that were not included in either the RI or CMP programs that may be causing adverse effects on the RMA biota, but it is doubtful that any other non-target analyte is more abundant in the biota than dieldrin.

The RMA's aquatic biota is equivalent to the terrestrial in that contamination exists in varying concentrations in most species. As stated above, dieldrin and mercury are the most abundant contaminants detected in the aquatic biota.

It should be noted that exposure to RMA media (soil, sediments, or surface water) is not the only source of chemical exposure to the RMA wildlife. Contamination is directly transferred from lower trophic levels of biota to the upper levels through predation. When a predominant prey base becomes contaminated, this directly affects all species which rely on this prey base for food, and spreads the contamination to wildlife living within the boundaries of RMA and to migratory wildlife that may pick up contamination during relatively short visits at RMA.

The significant concentrations of various target analytes detected in the tissues of RMA fortuitous samples are of particular concern. The Army and U.S.F. & W. have been urged to undertake histological studies and surveys to identify the cause of death of these animals to gain a better understanding of the

overall health of the populations and contaminant-related effects. Without this information, the RI and CMP program simply characterizes the amount of contamination that exists in the RMA biota without answering the question of what effect this contamination is having on the RMA ecosystem.

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Table 1. Results of the Biota RI Terrestrial Sampling Program.

Species/ Tissue	Location/ Sample Size	Analytes/Results	Comments
Morning glory aboveground parts	6 samples from Basin A	5 Analytes As=1 hit at .535 ppm Dield=2 hits .081 and .084 ppm	As, Hg, Ald, Dield, End, only analytes for plants
Sunflower leaves	5 samples from Basin A	5 Analytes As=4 hits, mean=1.37 ppm	Only positive detections in leaves. Nothing in flowers
	1 sample from Basin C	Dield=1 hit, over .3 ppm End=1 hit, .188 ppm	
Earthworms	2 composited samples from South Plants	7 Analytes Dield=1 hit, 1.93 ppm Hg=1 hit, over 2.35 ppm Second sample analyzed for Hg only.	The onpost control in Section 5 had 8 samples, all of which had As. Also had hits for Hg, Dield, and End.
Grasshoppers	4 composited samples from Basin A	7 Analytes As=4 hits, mean 3.17 ppm Hg=2 hits, .108 and .072 ppm Dield=4 hits, mean .381 ppm	No DDE or DDT found in any grasshoppers
	2 composited samples from Basin C	Ald=2 hits, .163 and .046 ppm Dield=2 hits, 1.19 and .496 ppm End=1 hit, .145 ppm	
	2 composited samples from Basin F	Ald=2 hits, .353 and 5.80 ppm Dield=2 hits, 1.23 and 7.20 ppm End=2 hits, .283 and 1.65 ppm	
Bald Eagle Egg	Barr Lake/1 sample.	7 Analytes Hg=.099 ppm Dield=.808 ppm DDE=6.93 ppm	Embryo said to exhibit normal development

Table 1 (cont'd.)

Species/ Tissue	Location/ Sample Size	Analytes/Results	Comments
Kestrels/ juvenile carcass	10 collected across RMA	6 Analytes, As not analyzed Dield=6 hits, mean .316 ppm DDE=1 hit. .219 ppm	Map shows 1 fewer sample than text. One offpost sample had DDE=.733 ppm
Kestrel eggs	34 eggs across RMA	6 Analytes, As not analyzed Hg=8 hits, mean .187 ppm Dield=17 hits, mean .512 ppm DDE=1 hit. 1.25 ppm	
Ferruginous Hawk Brain	5 dead hawks across RMA	7 Analytes Hg 1 hit, .152 ppm Dield=4 hits, mean 5.07 ppm	Highest dieldrin hit in brains, 9.98 ppm
Liver		Hg=1 hit. .293 ppm	
Raptor's Brains	5 Ferruginous Hawks 4 Great Horned Owls 3 Red Tailed Hawks 2 Golden Eagles	7 Analytes Hg=3 hits, Range .050 to .152 ppm Dield=10 hits, Range .175 to 15.6 ppm DDE=2 hits, Range .475 to 10.3 ppm	Raptor summary includes previous ferruginous data. Hit #s taken from Map. May not be exact.
Liver	Birds found dead across RMA	Hg=4 hits, Range .050 to .345 ppm Dield=15 hits, Range .031 to 27.7 ppm DDE=4 hits, Range .094 to 15.5 ppm	
Northern Harrier eggs	Upper Derby Lake 2 eggs	7 Analytes ? Dield=2 hits .303 and .676 ppm	USFWS collection
Coyote Liver	1 found dead in Section 25	7 Analytes ? Dield=7.6 ppm	No other tissues examined.

Table 1 (cont'd.)

Species/ Tissue	Location/ Sample Size	Analytes/Results	Comments
Badger liver	1 found dead in Section 25	5 Analytes, DDT/DDE not included. Dield=1.64 ppm	
Kidney		3 Analytes. OCPs only Dield=.801 ppm	
Mallards carcass, juvenile and adult	3 in Havana Pond 4 in Rod and Gun Pond 2 in lower Derby 1 in Lake Ladora 1 in North bog	6 Analytes - As not analyzed Hg=3 hits Range .061 to .066 ppm Dield=5 hits, Range .031 to 4.53 ppm DDE=5 hits, Range .094 to .507 ppm	
Mallard eggs	2 North of Derby lakes	Hg=2 hits, .173 and .185 ppm Dield=2 hits, 3.0 and 4.89 ppm DDE=2 hits, .606 and .919 ppm	
Waterfowl Liver	Upper Derby Lake 3 Teal 5 Redhead 9 Coot	7 Analytes Hg=17 hits, Range .08 to 1.77 ppm Dield=16 hits, Range .106 to .747 ppm DDE=1 hit, .156 ppm Ald=1 hit, .088 ppm End= 1 hit, .074 ppm	
Muscle		Hg=13 hits, .050 to .559 ppm Dield=16 hits, .062 to 1.77 ppm DDE=2 hits, .094 to .313 ppm	

Table 1 (cont'd.)

Species/ Tissue	Location/ Sample Size	Analytes/Results	Comments
Ring-Necked Pheasant	12 across RMA	6 Analytes-No Endrin As=3 hits, Range .25 to 1.82 ppm	Additional samples from MKE reported As and Dield in muscle. Dieldrin and DDE in liver.
Juvenile carcass	11 sampled for As	Dield=5 hits, Range .031 to 1.33 ppm	
Adult carcass	4 across RMA	Dield=3 hits, Range .031 to 2.92 mean .767 ppm	
Ring-Necked Pheasant eggs	11 total. From Derby and Ladora Lakes, and along First Creek	7 Analytes Dield=9 hits, Range .031 to 5.38 mean, 1.12 ppm End=1 hit, .143 ppm	
Morning Dove carcass	2 found dead by Bldg. 111	7 Analytes Ald=2 hits, .063 and 1.83 ppm DDE=2 hits, .800 and 3.44 ppm Dield=2 hits, 5.57 and 56.3 ppm	Highest dieldrin levels of any species analyzed
liver	1 taken south of Section 36	7 Analytes Dield=7.37 ppm End=3.74 ppm	
Cottontail Rabbits muscle	7 taken from section 36, South of Basin A	5 Analytes. No DOT/DDE Dield=3 hits, Mean .058 ppm	Controls in NW Section 20 were all BDL

Table 1 (cont'd.)

Species/ Tissue	Location/ Sample Size	Analytes/Results	Comments
Mule Deer muscle	14 collected across RMA	5 Analytes No DOE/DOE All BDL	
Liver		Dield=1 hit, .187 ppm	
Prairie Dogs	14 from Section 36 during summer and winter	5 Analytes. No DOE/DOE As=2 hits, .478 and .741 ppm Dield=14 hits, Mean 1.819 ppm	As only found in summer, only Dield higher in summer. A few very high Dield hits.
carcass	5 from Toxic Storage Yard	5 Analytes As=1 hit, 4.22 ppm Dield=5 hits, Mean .114 ppm	Shell/MKE also took some prairie dog samples. The results were similar to Army's but have not been included in this table.
kidney	5 from Section 36	5 Analytes Hg-3 hits, Mean .178 ppm Dield=2 hits, .248 and 1.54 ppm	

Table 4.3-5. Contaminant Levels in Aquatic Ecosystems (page 2 of 2).

SPECIES	Tissue	Location	Contaminant Level in parts per million (mg/kg wet weight basis) (Range/mean*)						
			Arsenic (n/nt)	Mercury (n/nt)	Aldrin (n/nt)	Dieldrin (n/nt)	Endrin (n/nt)	DDT (n/nt)	P.P.T.-DDT (n)
Bluegill	Fillet	RHA Lake Haru, 1986	BDL (3)	<0.050-0.099 0.671 (2/3)	BDL (3)	<0.031-0.041 (1/3)	BDL (3)	BDL (3)	BDL (3)
	Whole	RHA Lake Haru, 1986	BDL (6)	<0.050-0.137 0.061 (3/6)	BDL (6)	<0.031-0.158 0.085 (5/6)	BDL (6)	BDL (6)	BDL (6)
Bluegill	Whole	RHA Lower Derby, 1988	BDL (6)	<0.050-0.091 0.056 (3/6)	BDL (6)	<0.031-0.129 0.071 (4/6)	BDL (6)	BDL (6)	BDL (6)
	Whole	RHA Lower Derby, 1986	BDL (3)	BDL (3)	BDL (3)	0.142-0.161 0.149 (3/3)	BDL (3)	BDL (3)	BDL (3)
Bluegill	Whole	RHA Lake Ladara, 1986	BDL (3)	0.059-0.124 0.081 (3/3)	BDL (3)	0.065-0.153 0.100 (3/3)	BDL (3)	BDL (3)	BDL (3)
	Fillet	Offpost Control, 1988	BDL (5)	0.001-0.256 0.188 (5/5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)
Bluegill	Remainder	Offpost Control, 1988	BDL (5)	<0.050-0.111 0.101 (4/5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)
	Compos.(Whole)	Offpost Control, 1988	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)
	Whole(Reconst.)	Offpost Control, 1988	BDL (5)	0.000-0.178 0.141 (5/5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)
Northern Pike	Fillet	RHA Lower Derby, 1986	BDL (3)	0.270-0.470 0.405 (3/3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)
	Fillet	RHA Lake Ladara, 1986	BDL (2)	0.209-0.366 (2/2)	BDL (2)	<0.031-0.044 (1/2)	BDL (2)	BDL (2)	BDL (2)
Fathead Minnow	Composite	RHA North Bog, 1986	BDL (1)	BDL (1)	BDL (1)	BDL (1)	BDL (1)	BDL (1)	BDL (1)
	Whole	RHA Lower Derby, 1986	BDL (3)	<0.050-0.052 (1/3)	BDL (3)	0.085-0.209 0.144 (3/3)	BDL (3)	<0.094-0.098 (1/3)	BDL (3)

* Mean is calculated when 50 percent or more of samples (n > 2) have detectable contaminant levels. If less than 50 percent of samples have detectable contaminant levels, only the range of values are presented. When calculating the mean, values of 1/2 the detection limit are substituted for 'BDL'.

BDL = Below Detection Limit (Below Certified Reporting Limit).

n = Number of samples analyzed that contain detectable contaminants, nt = Total number of samples.

Compos. (Whole) = A number of small fish in a composite sample.

Whole (Reconst.) = A sample comprised of a portion of the fillet and remainder samples reconstituted into a 'whole' sample.

Sources: HNE, 1988 and ESE, 1988.

Table 4.3-5. Contaminant Levels in Aquatic Ecosystems (page 1 of 2).

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AQUATIC PLANTS AND PLANKTON									
Plankton	Composite	RHA Lake Haru, 1986	<0.250-0.432 (1/3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)
	Composite	RHA Lake Ladora, 1986	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)
	Composite	RHA Lower Derby, 1986	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)
	Composite	RHA North Bog, 1986	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)
Aquatic Macrophytes	Whole	RHA Lake Haru, 1986	0.465-0.782 (2/2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)
	Whole	RHA Lake Ladora, 1986	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)
	Whole	RHA Lower Derby, 1986	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)
FISH	Largemouth Bass	Fillet	BDL (5)	0.111-0.236 0.152 (5/5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)
		Remainder	BDL (5)	0.058-0.120 0.004 (5/5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)
	Compos. Whole	Whole	BDL (1)	0.004 (1)	BDL (1)	BDL (1)	BDL (1)	BDL (1)	BDL (1)
		Whole(Reconst.)	BDL (5)	0.086-0.157 0.109 (5/5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)
		Fillet	BDL (5)	0.176-0.550 0.369 (5/5)	<0.020-0.044 (1/5)	<0.031-0.370 0.212 (1/5)	BDL (5)	<0.094-0.684 0.319 (1/5)	BDL (5)
Largemouth Bass	Remainder	BDL (5)	0.190-0.319 0.250 (5/5)	<0.020-0.053 0.031 (1/5)	BDL (1)	BDL (1)	BDL (1)	BDL (1)	
	Compos. Whole	BDL (1)	0.098 (1)	BDL (1)	BDL (1)	BDL (1)	BDL (1)	BDL (1)	
	Whole(Reconst.)	BDL (5)	0.183-0.394 0.294 (5/5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	BDL (5)	
Largemouth Bass	Whole	BDL (3)	<0.050-0.101 0.066 (2/3)	BDL (3)	<0.031-0.115 (1/3)	BDL (3)	BDL (3)	BDL (3)	
	Fillet	BDL (2)	<0.050-0.101 (1/2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	
	Whole	BDL (3)	0.081-0.235 0.182 (3/3)	BDL (3)	<0.031-0.031 0.027 (2/3)	BDL (3)	BDL (3)	BDL (3)	
Largemouth Bass	Whole	BDL (3)	<0.050-0.063 (1/3)	BDL (3)	<0.031-0.112 0.072 (2/3)	BDL (3)	BDL (3)	BDL (3)	

Table 3. 1988 and 1989 Terrestrial Biota CMP Results
Positive Detections vs. Sample Size

Analyte	Primary Producers						% In Trophic Level
	Cheatgrass	Sunflower	Kochia	Prickly Lettuce			
Aldrin	2/39	1/13	1/27	0/14			4%
Dieldrin	20/38	9/13	3/27	7/14			42%
Endrin	2/39	1/13	1/27	0/14			4%
DDT	2/39	0/13	1/27	0/14			3%
DDE	1/39	0/13	0/27	0/14			1%
Arsenic	4/39	5/36	4/27	1/14			12%
Mercury	0/39	0/36	0/17	0/14			0%

Analyte	Herbivores						% In Trophic Level
	Grasshopper	Prairie Dog	Deer	Cottontail	Morning Dove		
Aldrin	0/39	0/62	0/10	0/17	1/38		1%
Dieldrin	24/39	52/60	2/10	7/12	26/38		70%
Endrin	3/39	2/62	0/10	0/17	11/38		10%
DDT	3/39	1/62	0/10	0/18	0/38		2%
DDE	0/39	2/62	0/10	0/18	2/38		2%
Arsenic	1/39	10/44	0/10	0/15	1/38		8%
Mercury	0/39	1/44	0/10	1/19	0/38		1%

Table 3 (cont'd.)

Analyte	Omnivores							
	Deer Mouse	Ground Beetle	Pheasant	13 Lined Ground Squirrel	Meadowlark	% in Trophic Level		
Aldrin	3/47	3/8	0/71	0/3	0/5	4%		
Dieldrin	37/44	8/8	36/71	2/2	5/5	68%		
Endrin	1/47	4/8	0/71	0/2	0/5	4%		
DDT	2/47	0/8	0/71	0/3	0/5	1%		
DDE	2/47	1/8	12/71	0/3	0/5	11%		
Arsenic	2/47	6/8	0/56	0/3	0/5	7%		
Mercury	4/47	0/8	2/53	0/2	0/5	5%		

Analyte	Carnivores		% in Trophic Level	Detritivores	% in Trophic Level
	Kestrel	Burrowing Owl			
Aldrin	0/15	0/2	0%	3/38	8%
Dieldrin	9/10	2/2	92%	32/38	84%
Endrin	0/15	0/2	0%	7/34	21%
DDT	0/15	0/2	0%	5/38	13%
DDE	4/12	1/2	36%	8/38	21%
Arsenic	0/15	0/2	0%	30/38	100%
Mercury	0/15	0/2	0%	24/38	63%

Table 4. 1988 & 1989 Aquatic Biota CHP Results
Positive Detections vs. Sample Size

Primary Producers						
Analyte	Coontail	Sego Pondweed	American Pondweed	Leafy Pondweed	% in Trophic Level	
Aldrin	0/6	NA	0/12	0/13	0%	
Dieldrin	0/6	NA	0/12	0/13	0%	
Endrin	0/6	NA	0/12	0/13	0%	
DDT	0/6	NA	0/12	0/13	0%	
DDE	0/6	NA	0/12	0/13	0%	
Arsenic	4/12	6/9	8/24	0/13	31%	
Mercury	0/11	0/9	1/24	0/13	2%	

Analyte	Primary Consumers		Water-Column Omnivores			% in Trophic Level
	Plankton	% in Trophic Level	Hallard	Coot	B-U Teal	
Aldrin	0/15	0%	1/14	0/12	0/4	3%
Dieldrin	0/15	0%	13/13	11/12	4/4	97%
Endrin	0/15	0%	1/14	0/12	0/4	3%
DDT	0/15	0%	0/14	0/12	0/4	0%
DDE	0/15	0%	4/14	3/12	2/4	30%
Arsenic	17/30	57%	0/15	0/12	0/4	0%
Mercury	0/30	0%	12/13	5/12	4/4	72%

Table 4 (cont'd.)

Analyte	Bottom Feeding Omnivores		% In Tropic Level	Primary Carnivores		% In Tropic Level
	Bullhead	Catfish		Killdeer	Bluegill	
Aldrin	0/11	0/7	0%	0/5	0/30	0%
Dieldrin	4/11	7/7	61%	5/5	21/30	74%
Endrin	1/11	1/7	11%	3/5	1/30	11%
DDT	0/11	0/7	0%	2/5	0/30	6%
DDE	1/11	6/7	39%	5/5	0/30	14%
Arsenic	0/11	0/7	0%	0/5	0/30	0%
Mercury	8/11	37	61%	5/5	25/30	86%

Analyte	Top Carnivores		% In Tropic Level
	Northern Pike	Largemouth Bass	
Aldrin	0/7	0/29	0%
Dieldrin	6/7	25/29	86%
Endrin	0/7	1/29	3%
DDT	1/7	2/29	8%
DDE	6/7	16/29	61%
Arsenic	0/7	0/29	0%
Mercury	7/7	29/29	100%