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Agency for Toxic Substances and Disease Registry

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FINAL REPORT

Technical Assistance to the Idaho State Health Department
and the Indian Health Service

THE RELATIONSHIP OF HUMAN LEVELS OF LEAD AND CADMIUM TO THE CONSUMPTION OF FISH CAUGHT IN AND AROUND LAKE COEUR D'ALENE, IDAHO

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TECHNICAL ASSISTANCE TO THE IDAHO STATE HEALTH DEPARTMENT
AND THE INDIAN HEALTH SERVICE

SEPTEMBER 1989

FINAL REPORT

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ABSTRACT

The Idaho State Health Department and the Indian Health Service asked the Agency for Toxic Substances and Disease Registry (ATSDR) to determine whether the consumption of fish captured in Lake Coeur d'Alene (LCD) and the Coeur d'Alene River, as well as the adjacent Chain Lakes, could substantially increase lead and cadmium levels in human blood and urine. A pilot exposure study was conducted in a cooperative effort involving the Idaho State Health Department, the Indian Health Service, the Panhandle County Health Department, the Idaho Department of Fish and Game, and the ATSDR. The goal of this study was 1) to characterize fish and duck acquisition and consumption patterns of people living around LCD, and 2) to determine the association between fish and duck consumption and lead/cadmium levels.

The lead and cadmium levels among participants living near Lake Coeur d'Alene were within the expected range and are not of any known clinical importance. There was no statistically significant association between fish or duck consumption and blood lead levels. After adjusting for age, smoking, and duck consumption, persons eating at least one fish meal per month were 3.4 times more likely to have urine cadmium levels greater than the median value of 0.2 ng/ml compared with persons who did not eat fish. Duck consumers in the month before the study were 2.1 times more likely to have urine cadmium levels greater than the median compared with persons who did not eat duck. These results were not statistically significant with respect to blood cadmium or urine cadmium adjusted for creatinine.

INTRODUCTION

The Idaho State Health Department and the Indian Health Service asked the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate the health implications of dietary exposure to lead- and cadmium-contaminated fish captured in Lake Coeur d'Alene (LCD), Coeur d'Alene (CD) River, and other surrounding lakes and streams. In response to this request, a pilot exposure study was conducted in cooperation with the State of Idaho Health Department, the Indian Health Service, the Panhandle County Health Department, the Idaho Department of Fish and Game, and the ATSDR.

Objectives

The goal of the study was 1) to describe local patterns of fish acquisition and fish consumption by residents of Kootenai and Benewah Counties (these counties encompass LCD and several of the surrounding lakes and rivers of concern), 2) to determine the association between fish consumption and lead and cadmium levels in blood and urine, and 3) to describe other game or vegetation (potentially contaminated with lead or cadmium) consumed and to determine the association of this consumption with lead and cadmium levels in blood and urine.

BACKGROUND

Environmental Data

Elevated lead and cadmium levels have been found in fish tissues in Lake Coeur d'Alene, CD River, and certain other lakes fed by the CD River. Heavy metals were believed to have washed into the lake from the now defunct Bunker Hill smelter waste site (a Superfund site) located by the Coeur D'Alene River. Fish sampling data (Table 1) analyzed for ATSDR (1) suggest that fish caught in LCD have lead and cadmium levels higher than the averages found in fish sampled throughout the United States by the National Pesticide Monitoring Program (NPMP)(2).

A memorandum prepared by ATSDR to review the fish sampling data expressed concern that the acceptable daily intake of lead and cadmium could be exceeded if daily consumption of fish caught locally was six ounces or more for adults and 2.5 ounces or more for children (1). The estimate for adults was calculated using fish with the highest lead and cadmium concentrations. The estimate for children was calculated using both the average and highest lead and cadmium concentrations. These estimates have limitations because 1) they are based on a small sample of fish (n=16); 2) the fish analysis included bone, which is not ordinarily eaten; and 3) the dietary intake of fish was estimated because no data were available to quantify the amount and frequency of fish consumption at that time.

Rationale for Study Design

The goal of this study was to describe patterns of fish acquisition and consumption in the Coeur d'Alene area and to determine whether biologic levels of lead and cadmium were associated with fish consumption. The study was designed to evaluate a population whose diet was high in fish caught from the rivers and lakes of the Coeur d'Alene area to identify groups with maximal potential exposure to lead and cadmium.

Certain geographic and demographic characteristics made the LCD area an ideal location to determine these patterns of fish acquisition and consumption. First, due to its size and the many adjacent lakes and streams, the area was used extensively for recreational fishing. Fish were readily accessible to all residents either from the shoreline or by boat. The Coeur d'Alene tribal group located on the southwest shore of LCD has traditionally fished Coeur d'Alene, Round, and Benewah Lakes and the surrounding streams (Figure 1). Most fishing occurred from the shore (3). Second, publicity about fish contaminated with heavy metals heightened public awareness, and the aforementioned agencies believed the local residents would be amenable to a health study.

Population Selection

Local health officials identified three fish consumer groups to participate in the study: members of the Coeur d'Alene Indian Tribe, holders of 1985 fishing licenses who lived in Benewah or Kootenai Counties and volunteers within the same counties.

1. Coeur d'Alene Tribal Members - Attempts were made during a 3-week door to door survey to identify all Indians living on the Coeur d'Alene Tribal Reservation. Because this group traditionally relied upon LCD and its adjacent lakes and streams for fishing, it was hypothesized that they consumed more locally caught fish than non-tribal fisherman. An Indian Health Service (IHS) census conducted in the summer of 1985 indicated that 853 individuals lived on the Reservation; however, only 572 individuals were identified in this survey. The discrepancy between the surveys may be due to migration, and the IHS survey may have included tribal members who did not live on the reservation.

2. Fishing Licenses - A sample of 250 names was drawn from a computer listing in the Idaho Department of Fish and Game of all holders of 1985 fishing licenses identified by zip code as living in Benewah or Kootenai Counties (n=19,577). Of the 250, 55 (22%) consented to participate, 95 (38%) refused, and 77 (31%) individuals could not be contacted. For 23 (9%) individuals, the reason for nonparticipation was not recorded.

3. Volunteers - Residents of Kootenai and Benawah Counties were invited to volunteer for the survey to help identify a group of residents likely to be "very high" consumers of fish. Newspaper and radio advertisements were used to recruit study participants. Field and game officers identified individuals who were known to fish in the area. Health officials attended a sportsmen's meeting and contacted fishing derby entrants to solicit participants. These fishermen were asked to identify other high consumers of fish. Individuals from 101 households volunteered, resulting in the identification of 298 household members.

Sample Selection

Participants were identified and selected in three phases (Figure 2):

Phase I - (July 21 - August 15, 1986)

Adults (aged 18 years and older) identified as heads of households or household food preparers responded to the first questionnaire. This questionnaire was used to identify all individuals living in the households, and to assess local fish acquisition and fish intake for all household members. Demographic information was available for 933 household members from 299 households.

Phase II - (September 23 - October 10, 1986)

Four categories were defined using the number of fish meals reportedly eaten per week (estimated from the Phase I questionnaire): 1) high consumers - individuals consuming locally caught fish three or more times per week, 2) moderate consumers - individuals consuming locally caught fish one to two times per week, 3) low consumers - individuals consuming locally caught fish less than once a week, and 4) non-consumers. A stratified random sample based on the number of weekly fish meals reported was used to select Phase II participants. The sample was weighted in proportion to the distribution of individuals by population group. Because relatively few high consumers were identified, all high consumers were invited to participate in Phase II.

Of the 933 eligible adults and children identified in Phase I, 178 were selected for Phase II, and of these, 105 (59%) agreed to participate. These participants completed a second questionnaire and provided blood and urine samples for lead and cadmium analysis.

Phase III-(August 3-7, 1987)

Fifty participants from Phase II were selected to participate in Phase III. All respondents who previously indicated that they ate three or more

fish meals during the height of the fishing season were invited to participate. The remaining potential participants were randomly selected from the moderate or low fish-consumption groups. Thirty-three (66%) of the 50 agreed to complete a third questionnaire and to submit second blood and urine samples approximately 10 months after the completion of Phase II. Data from Phase III were compared with those from Phase II to determine whether lead and cadmium levels differed between the two periods. Fish were presumed to be more available during August and it was hypothesized that blood and cadmium levels would be higher when fish were eaten more frequently.

Questionnaire Administration

All three questionnaires (Attachment 1) were administered by interviewers trained by the Idaho state epidemiologist. Interviewers included nurses from the Panhandle County Health Department and a paid Tribal Representative. Interviews were conducted either by telephone or in-person in participant homes, workplaces, or community centers. Respondents were asked to refer only to locally caught fish when answering the questionnaires. All interviews in tribal households were completed in-person because telephone service was not available for many members.

Three attempts were made to contact a representative of each tribal household at home. Three attempts were made to contact individuals listed on the fishing license roster by telephone. Many telephone numbers and addresses of the fishing license group were outdated making contact difficult. Individuals were traced using resources such as the telephone book, telephone operator assistance and office records of the local health department. Home visits were attempted if only a street address was available, but because the study area was so large, only one visit was attempted.

Phase I Questionnaire

One adult (18 years of age or older) identified as the head of household or food preparer completed the Phase I questionnaire for each household. Information on age, sex, and length of residence was recorded for each household member. The questionnaire assessed household patterns of fish acquisition and diet (number of fish meals served per week; average number of 8-inch fish eaten per meal; preferred fishing location; preferred catch), as well as dietary patterns for other locally acquired consumables (ducks and geese; water potatoes; wild rice).

Phase II Questionnaire

The second questionnaire was administered to a sample of household members identified in Phase I. Children younger than 18 years responded with the help of an adult. The questionnaire was designed to ascertain the frequency of fish meals consumed per week in August, 1986, the month preceding the Phase II survey and during the period when fish were reported to be most available (May through July).

Information about consumption of waterfowl, rice and water potatoes was also obtained. Questions to assess other routes of lead or cadmium exposure, including potential exposure through occupations, hobbies, personal habits, and recreation, were included. Indicators of socioeconomic status, such as income and education, were also obtained.

Phase III Questionnaire

The Phase III questionnaire was administered to a sample of Phase II participants. This questionnaire ascertained patterns of fish, and duck and geese consumption patterns among Phase III study participants.

Biologic Specimens

Biologic specimens were requested from all participants in Phases II and III. Blood samples for the analysis of lead, cadmium, and free erythrocyte protoporphyrin (FEP) and urine samples for the analysis of cadmium and creatinine were collected in accordance with the protocol developed by the Nutritional Biochemical Branch, Division of Environmental Health Laboratory Sciences, Center for Environmental Health, Centers for Disease Control (See relevant sections in Attachment 2).

Blood lead, blood cadmium, and urine cadmium concentrations were determined by graphite furnace, atomic absorption spectroscopy. The FEP concentration was determined by fluorescence spectroscopy. Blood lead concentrations were determined using a modified method by Fernandez and Hilligoss (4). Blood cadmium analyses were conducted using a method by Stoeppler (5), and urine cadmium analyses were conducted using a method by Pruszkowska et. al.(6). FEP was analyzed using a modified method by Sassa et. al.(7). Urine creatinine analyses were conducted using a method by DuPont (8).

Privacy and Notification

This final report and all reports made available to the public do not contain individual participant identifiers but only report aggregate data. All records are treated as confidential and will be maintained in compliance with the Privacy Act of 1974. Under the Privacy Act of 1974 (5 U.S.C. Section 552a[e]), employees of federal agencies are responsible for protecting data collected on identifiable persons or organizations when the supplier of those data has not given the agency consent to make the data public. The responsibility for protection includes unauthorized visual observation, accidental loss, and theft of data. This implies that confidential records should be kept out of sight of unauthorized persons, stored in locked cabinets or locked rooms when not being used, copied only when absolutely necessary, and stored in sealed containers when transferred to archives. Statistics derived from confidential data should be reported without inadvertent disclosure about specific study subjects.

Individual results of laboratory tests have been provided to the participants, or, in the case of minors, to parents or legal guardians. ATSDR provided interpretations of these tests and health recommendations, if necessary. In the event a test revealed findings significant enough to jeopardize a person's health, ATSDR would have immediately notified that person or guardian and a physician or health care provider designated by that person or guardian.

Data Analysis

Laboratory values of all analytes that were less than the detectable limit were redefined as one half the detectable limit. Because of the skewed distributions of laboratory data (blood lead levels, blood and urine cadmium levels, erythrocyte protoporphyrin, and the urine cadmium/creatinine ratio), natural logarithm transformations of these data were used in all analyses.

Urine cadmium values were adjusted by urine creatinine to account for differences in urine concentration using the following formula:

$$\text{Urine Cadmium (ug)/g Creatinine} = \frac{\text{UCd ng/ml}}{\text{UCr mg/ml}} \times 100$$

where UCd = urine cadmium
UCr = urine creatinine

The Statistical Analysis System supported all data analyses (9). Student's t-test and the analysis of variance were used to compare mean differences between groups. The paired t-test was used to compare lead and cadmium concentrations for the 33 participants in Phase II and III. Chi square and Fisher's exact tests were used to compare categorical differences between groups.

The odds ratio and 95% confidence intervals were used to determine the association between the laboratory variables and potential risk factors. For analysis purposes, the laboratory values were dichotomized into upper and lower median values for the entire study population. The median was 5.4 ug/dl for lead, 0.5 ng/ml for blood cadmium, 0.2 ng/ml for urine cadmium, and 2.4 ug/g for urine cadmium adjusted for creatinine.

Logistic regression was used in the multivariate analysis to adjust for the effects of other risk factors and to control for potential confounding. All risk factors and confounding variables were first entered into the model and then eliminated one at a time in a step-down approach. The dependent variable was the laboratory value; the independent variables are shown in Table 2. The likelihood ratio test was used to determine the goodness of fit between models. Odds ratios were calculated by taking antilogarithms of the parameter (beta) determined from the maximum likelihood estimates. Complete data were available for analysis on 81 of the 105 individuals.

RESULTS

Phase I

In Phase I, 299 households and 933 individuals were identified. Of these 47%, were tribal members, 33.8% were volunteers, and 18.4% were holders of fishing licenses. The demographic characteristics of the population are shown in Table 3. Statistically significant differences between the groups were found with respect to age, native American race, and area and length of residence. The tribal members (mean age 28.8 ± 21.0) were younger than the volunteers (35.9 ± 22.7) and fishing licensees (31.9 ± 21.1). The groups did not differ statistically by gender.

Household patterns of fish acquisition and serving are shown in Table 4. Although fewer tribal households served meals containing fish than did fish licensee or volunteer households, the tribal households that did serve fish tended to serve more fish meals per week. The tribal households also served more bottom feeders (catfish, bull heads, suckers) and lake feeders (perch, crappies, bass, pike) and less salmon (kokanee, blue backs, trout, chinook, white fish) than did the other groups. Lake Coeur d'Alene was the preferred fishing lake among the volunteers, while the tribal members and fish licensees preferred the lakes located farther south (Benewah, Round, Chatcolet).

The head of household (or food preparer) was asked to estimate the number of meals containing fish, ducks (or geese), water potatoes, and wild rice eaten by individuals in that household. With the exception of water potatoes, the tribal members ate these foods less frequently than did the other groups, the differences being statistically significant (Table 5).

The mean number of 8-inch fish eaten per meal for adult males, adult females, and children, as estimated by the head of the household, is shown in Table 6. Males ate more than females and children, but the amount did not differ between groups. An average 8-inch trout weighs 5 - 7 ounces, resulting in 2.5 - 3.5 ounces of dressed fish, much less if filetted. The estimate of dressed fish eaten is 8.5 - 13.7 ounces for males, 5.8 - 8.1 ounces for females, and 4.5 - 6.3 ounces for children.

Phase II

The sample selection and study participation rates for Phase II are shown in Table 7. A sample of 178 individuals was chosen, and 105 (59%) agreed to participate. The demographic characteristics of the Phase II participants are shown in Table 8. The groups did not differ by age, gender, nor number of years resident in Benewah or Kootenai Counties. As expected, the tribal members generally identified themselves as Native Americans and lived on the Couer d'Alene Reservation. There were

statistically significant differences by socioeconomic status; the tribal members were less well educated ($p = 0.02$) and had lower income ($p = 0.001$) than the volunteer and fishing license groups. Current smokers made up 41.5% of the tribal group compared with 15.8% of the volunteers and 21.4% of the fishing licensees ($p = 0.02$).

Fish and duck consumption reported by each participant is shown in Table 9. Compared with the other groups, the tribal members reported eating fish less frequently in August, the month preceding Phase II, and in May through July, the period when fish were reported to be most available. The frequency of duck consumption did not differ between the groups.

Results of the lead and cadmium laboratory analyses by study group are shown in Table 10. Blood lead concentrations for all participants ranged from 1.2 to 20.2 ug/dl. Blood lead concentrations for children aged 6 years or less ranged from 1.2 to 11.2 ug/dl (mean 7.4 ug/dl $\pm$ 3.9). Blood cadmium concentrations for all participants ranged between 0.05 and 5.8 ng/ml. Two individuals had blood cadmium levels higher than the expected range of 5.0 ng/ml, but their urine cadmium levels were within the normal range. Blood cadmium concentrations for children aged 6 or less ranged from 0.05 to 0.5 ng/ml. The population urine cadmium range was 0.05 - 1.4 ng/ml. The free erythrocyte protoporphrin ranged from 11 to 59 ug/dl.

Table 11 shows the odds ratios and 95% confidence intervals for blood lead levels (lowest versus highest median) by duck and fish consumption. No statistically significant associations were found between fish and duck consumption and blood lead concentration.

Tables 12 - 14 present odds ratios and 95% confidence intervals for cadmium concentration by duck and fish consumption. Cadmium concentration was analyzed by three methods: urine cadmium, blood cadmium, and urine cadmium adjusted by creatinine. All three measurements were dichotomized into the lowest and highest median for analysis purposes.

No statistically significant associations were found between cadmium concentration and duck consumption. A statistically significant association did exist between cadmium levels in persons who ate one to three fish meals per week in August preceding Phase II compared with levels in persons who ate no fish. The odds ratio was 7.6 (95% confidence interval (CI) 1.9 - 31.2) for urine cadmium greater than 0.2 ng/ml, and 3.1 (95% CI 1.0 - 10.0) for blood cadmium adjusted for creatinine greater than 2.4 ug/g creatinine. The risk remained elevated for persons who ate three to six fish meals per week during the months May through July when fish were reported to be most available. The odds ratio was 6.5 (95% CI 1.3 - 32.4) for urine cadmium and 5.5 (95% CI 1.1 - 27.6) for urine cadmium adjusted for creatinine.

Logistic regression was used to adjust for the effect of several covariables. All variables shown in Table 2 were entered into the regression model for each of the four laboratory values. Table 15 shows the model that best fit the data for each outcome. Fish and duck consumption during the month previous to the study were associated with urine cadmium levels, the odds ratios being 3.4 (95% CI 1.5 - 8.0) for fish and 2.1 (95% CI 1.1 - infinity) for duck. However, this association was not statistically significant with respect to urine cadmium adjusted for creatinine. Duck consumption during August was negatively associated with blood lead level and was of borderline statistical significance (odds ratio 0.01, 95% CI 0.007 - 1.00)

Phase III

Sixty-six percent (33/50) of the individuals sampled in Phase II agreed to participate in Phase III. These participants submitted second blood and urine samples for lead and cadmium analysis, and the results are shown in Table 16. No statistically significant differences were found between study groups.

A comparison was made between the laboratory results from Phase II and the results from Phase III, collected ten months later (Table 17). Blood lead levels and urine cadmium levels adjusted for creatinine were significantly lower in the later samples. To determine whether changes in fish or duck consumption could account for these differences, we compared consumption patterns in Phase II with those reported in Phase III (Table 18). No statistically significant differences in patterns of fish consumption were found between the two periods.

DISCUSSION

Study limitations

In general, the participation rates for Phase II and Phase III of this study were lower than optimal. It cannot be determined whether participants differed from non-participants with respect to dietary patterns and whether this biased the results of this study to any degree.

The population for this study was so selected because it was thought to be at risk for lead and cadmium exposure through high dietary consumption of potentially contaminated fish. However, only 33% of the tribal members indicated that they served meals containing fish. It could not be determined whether this reflected the historical prevalence of fish consumption or whether fewer tribal members fished because of concerns about the highly publicized Lake Coeur D'Alene contamination.

Because the study participants had lead and cadmium levels well within the reference range for unexposed populations, it may not be appropriate to generalize the results of this study to populations that show elevated levels of lead or cadmium.

Because of the small sample size (n = 105), this study had limited power to reject the null hypothesis. The power to detect an association between blood lead levels and fish consumption (shown in Table 11) ranged between 6.1% and 12.9%. The power to detect an association between urinary cadmium levels and fish consumption (Table 12) was slightly better, 15.9% to 41.7%.

Results

Environmental data on fish caught in Lake Couer d'Alene raised concerns that the daily consumption of these fish could result in an intake of lead and cadmium that could exceed the acceptable dietary intake. The purpose of this study was twofold: first, to provide descriptive information about patterns of fish acquisition and consumption for people living around Lake Coeur d'Alene; and second, to determine the association between fish consumption and biologic levels of lead and cadmium.

Blood lead levels are indicative of recent (60 - 90 days) exposure to lead. The Centers for Disease Control has set recommended limits of blood lead levels below 25 ug/dl for pregnant women and children (10) and 40 ug/dl for adult workers with occupational exposure to lead (11). However, recent evidence suggests that adverse health effects may occur in children at concentrations as low as 15 ug/dl (12). According to the National Health and Nutrition Examination Survey II, the average blood lead concentration for all persons in the United States was 9.2 ug/dl (13). Blood lead levels for all participants in this study ranged from 1.2 to 20.2 ug/dl, well within the expected reference values.

The reference range for free erythrocyte protoporhyrin, a measure of iron deficiency associated with lead exposure, is less than 35 ug/dl for children and less than 60 ug/dl for adults (14). All participant values were within the reference ranges.

Blood cadmium levels are indicators of recent exposure, and urine cadmium levels reflect the body burden. The recommended blood cadmium concentration limit is less than 5 ng/ml and the urine cadmium limit adjusted for creatinine is less than 5 ug/g (11). Blood cadmium concentrations in the study population ranged between 0.05 and 5.8 ng/ml, and urine cadmium adjusted for creatinine ranged from 0.002 to 1.0 ug/g. Two individuals exceeded the reference blood cadmium range, but their urine cadmium levels were within the normal range.

No statistically significant associations were found between blood lead levels and fish or duck consumption in the univariate analysis. After adjusting for other risk factors, duck consumption was negatively associated with increased blood lead, although this result was of borderline statistical significance. Elevated blood lead levels were associated with age, gender, and occupational exposure to lead, risk factors that have been identified in other studies (13,15).

Fish consumption during August just before the study was associated with increased urine cadmium. After adjusting for age, smoking, and duck consumption, persons eating at least one fish meal per month were 3.4 times more likely to have urine cadmium levels greater than the median, 0.2 ng/ml, compared with non-fish eaters. Similarly, duck consumers in the month before the study were 2.1 times more likely to have urine cadmium levels greater than the median when compared with those who did not eat duck. These associations, however, were not statistically significant with respect to blood cadmium or urine cadmium adjusted for creatinine.

Cigarette smoking was the strongest risk factor for elevated blood and urine cadmium levels in this study, a finding consistent with other research (16). Smokers have roughly double the body burden of cadmium compared with non-smokers (16,17). For nonsmoking individuals who are not exposed to cadmium from industrial sources, food is generally agreed to be the greatest source of cadmium exposure (18).

For a 70 kg male, the maximal acceptable intake of lead is 430 ug/day and 70 ug/day of cadmium according to the World Health Organization (19). The data presented in this study were used to estimate that an adult male who ate 8.5 to 13.7 ounces of fish per day ingested an average of 192 - 311 ug lead per day and 32 - 52 ug cadmium per day, well within the recommended guidelines.

CONCLUSION

The lead and cadmium levels among participants living near Lake Coeur d'Alene were within the expected range and are not of any known clinical significance.

RECOMMENDATIONS

The results of this study cannot be used to determine a safe level of fish consumption. However, there is no indication that fish or waterfowl consumption should be curtailed below the amount reported by participants in this study.

AUTHORS AND ACKNOWLEDGEMENTS

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Table 1

Results of fish sampling in parts per million (PPM)

	Columbia River System[a]	All NPMS 1976-77	Lake Couer d'Alene 1985
	whole fish	whole fish	gutted fish[b]
CADMIUM			
number	117	112	16
mean	0.101*	0.112	0.134
geometric mean	0.084*		0.094
range	0.05-0.33		0.01-0.37
LEAD			
number	17	117	16
mean	0.335*	0.338	0.80
geometric mean	0.186*		0.45
range	0.10-2.57		0.12-3.30

[a] This system is included in all National Pesticide Monitoring Stations (NPMS), but results are shown separately because metal concentrations in fish from these Pacific Northeast rivers tended to be close to or greater than the upper 95% confidence limit value of data collected from all NPMS Stations.

[b] The fish were gutted just as in the way as they were prepared for cooking. Except for one brown bullhead that was filleted and only the muscle analyzed, most samples included fish heads, tails, and fins. Yellow perch samples (n=5) were skinned and did not contain tails and fins.

* For values below the assay detection limits, the value of the detection limit was used to calculate the mean.

Excerpted from: Review of fish sampling results Lake Coeur d'Alene, Idaho, ATSDR Memorandum, March 27, 1986 (1)

Table 2

Independent variables used in the regression analysis of Phase II

Age in years
- 0 - 19 (0)
- 20 - 39 (1)
- 40 - 59 (2)
- 60 + (3)

Group
- Tribal member (0)
- Volunteer (1)
- Fishing licensee (2)

Sex
- Female (0)
- Male (1)

Income
- < $5,000 (0)
- $5,000 - 14,999 (1)
- $15,000 + (2)

Current smoker
- No (0)
- Yes (1)

Lead related occupation
- No (0)
- Yes (1)

Lead related hobby
- No (0)
- Yes (1)

Fish meals/week last month
- 0 (0)
- < 1 (1)
- 1 - 3 (2)

Fish meals/week when most available
- 0 (0)
- < 1 (1)
- 1 - 6 (2)

Fish per serving
- 0 (0)
- 1 + (1)

Duck meals/week last month
- 0 (0)
- 1 + (1)

Duck meals/week when most available
- 0 (0)
- 1 + (1)

Usual fishing lake
- Coeur d'Alene (0)
- Other lakes (1)

Table 3

Demographic characteristics of Phase I participants by group

	Tribal members		Volunteers		Fishing licensees		P value
	n	%	n	%	n	%	
No. of households	143		101		55		
No. of participants	455		298		180		
Age							
0 - 9	89	19.6	49	16.4	34	18.9	< 0.001
10 - 19	99	21.8	44	14.8	32	17.8	
20 - 29	70	15.4	24	8.1	19	10.6	
30 - 39	74	16.3	55	18.5	36	20.0	
40 - 49	46	10.1	43	14.4	14	7.9	
50 - 59	36	7.9	28	9.4	26	14.4	
60 +	41	9.1	55	18.5	19	10.6	
Sex							
Male	238	52.3	150	50.3	87	48.3	0.65
Female	217	47.7	148	49.7	93	51.7	
Native American							
Yes	436	95.8	9	3.0	8	4.5	< 0.001
No	19	4.2	288	97.0	154	95.1	
Area of residence (%)							
CDL Reservation	451	99.1	6	2.1	0		< 0.001
City CDL	4	0.9	59	20.6	51	30.5	
S. of Round Lake	0		62	21.6	73	43.7	
E. or W. of CDL Lake	0		120	41.8	24	14.4	
Outside counties	0		20	7.0	19	11.4	
Years in Benewah or Kootenai Co.							
0 - 4	147	32.3	67	22.5	32	17.8	< 0.001
5 - 14	159	35.0	105	35.2	86	47.8	
15 +	149	32.7	126	42.3	62	34.4	

Table 4

Patterns of household fish acquisition and serving reported in Phase I, by group

	Tribal members		Volunteers		Fishing licensees		P value
	n	%	n	%	n	%	
Serves meals containing fish	33	23.1	100	99.1	52	94.6	< 0.001
Fish meals served/week							
< 1	16	48.5	73	74.5	44	84.6	0.004
1 - 2	14	42.4	19	19.4	8	15.4	
3 - 10	3	9.1	6	6.1	0		
Type of fish served							
Salmon species	30	90.9	93	93.0	48	94.1	0.85
Lake fish	25	75.8	76	76.0	33	64.7	0.31
Bottom feeders	16	48.5	29	29.3	11	21.6	0.03
Fish type served most often							
Salmon species	12	36.4	62	62.0	37	72.6	0.02
Lake fish	18	54.6	34	34.0	12	23.5	
Bottom feeders	3	9.1	4	4.0	2	3.9	
Lake most frequently fished							
Coeur d'Alene	3	9.1	43	43.9	10	19.6	< 0.001
Benewah, Round, and Chatcolet	23	69.7	19	19.4	19	37.3	
Lakes north of CDL	0		14	14.3	15	29.4	
Chain Lakes, CDL River	3	9.1	16	16.3	1	2.0	
Other lakes, rivers	4	12.1	6	6.1	6	11.8	

Table 5

Fish, duck, water potato, and wild rice consumption for Phase I study participants, by group

	Tribal members		Volunteers		Fishing licensees		P value
	n	%	n	%	n	%	
Frequency of meals containing fish eaten per week							
0	352	77.5	6	2.1	13	7.2	
< 1	31	6.8	201	68.6	134	74.4	< 0.001
1 - 2	54	11.9	60	20.5	29	16.1	
3 - 6	10	2.2	24	8.2	4	2.2	
7 - 14	7	6.9	2	0.7	0		
Frequency of meals containing duck/goose eaten per week							
0	420	92.3	199	67.9	157	87.2	
< 1	20	4.4	87	29.7	23	12.8	< 0.001
1 - 2	15	3.3	7	2.4	0		
Frequency of meals containing wild rice eaten per week							
0	437	96.3	218	74.4	161	89.9	
< 1	7	1.5	68	23.2	18	10.1	< 0.001
1 - 2	10	2.2	7	2.4	0		
Frequency of meals containing water potatoes eaten per week							
0	417	91.7	293	100.0	180	100.0	
< 1	31	6.8	0		0		< 0.001
1 - 2	7	1.5	0		0		

Table 6

Mean number of 8-inch fish eaten per meal by household members as estimated by the head of the household or food preparer in households serving fish in Phase I (n = 179)

	Tribal Members			Volunteers			Fishing License			P Value
	n	mean	SD	n	mean	SD	n	mean	SD	
Adult Males										
	30	3.9	3.0	95	3.3	1.6	47	3.1	1.3	0.18
Adult Females										
	21	2.5	1.6	91	2.4	1.6	50	2.0	1.1	0.53
Children under 12 years of age										
	15	2.2	1.5	33	1.7	1.5	22	1.8	1.3	0.54

n = number of persons

Table 7

Sample selection and study participation rate for Phase II by group

	Tribal members	Volunteers	Fishing licensees	Total
	n	n	n	n
High consumers (≥ 3 fish meals/week)	17	26	4	47
Moderate consumers (1 - 2 fish meals/week)	21	20	14	55
Low consumers (< 1 fish meal/week)	21	21*	14*	56
Non-consumers (0 fish meals)	20			20
Total sample	79	67	32	178
No. of participants	53	38	14	105
Participation rate (%)	(67)	(57)	(44)	(59)

* Participants were selected from the combined low- and non-consumer groups

Table 8

Demographic characteristics of Phase II participants, by group

	Tribal members		Volunteers		Fishing licensees		P value
	n	%	n	%	n	%	
Age							
0 - 19	19	35.9	8	21.6	4	28.6	0.12
20 - 39	19	35.9	7	18.9	4	28.6	
40 - 59	10	18.9	13	35.1	5	35.7	
60 +	5	9.4	9	24.3	1	7.1	
Sex							
Male	30	56.6	18	47.4	7	50.0	0.70
Female	23	43.4	20	52.6	7	50.0	
Race							
White	8	15.1	38	100.0	14	100.0	< 0.001
Black	1	1.9	0		0		
Native American	44	83.0	0		0		
Area of Residence							
LCD Reservation	53	100.0	0		0		< 0.001
City LCD	0		4	10.5	4	36.4	
S. of Round Lake	0		8	21.1	2	18.2	
E. or W. of LCD	0		24	63.2	5	45.5	
Outside counties	0		2	5.3	0		
Years in Benewah or Kootenai Co.							
≤ 1 - 4	16	31.4	10	26.3	2	14.3	0.75
5 - 14	17	33.3	14	36.8	5	35.7	
≥ 15	18	35.3	14	36.8	7	50.0	

Table 8 (continued)

Demographic characteristics of Phase II participants, by group

	Tribal members		Volunteers		Fishing licensees		P value
	n	%	n	%	n	%	
Education							
Grade 12 or less	12	22.6	9	24.3	1	7.7	0.02
High school grad	29	54.7	11	29.7	4	30.8	
Some college	10	18.9	8	21.6	4	30.8	
College degree +	2	3.7	9	24.3	4	30.8	
Income							
< $ 5,000	19	38.0	4	10.5	0		0.001
$ 5,000 - 14,999	18	36.0	14	36.8	3	23.1	
$ 15,000 +	13	26.0	20	52.6	10	76.9	
Current smoker							
Yes	22	41.5	6	15.8	3	21.4	0.02
No	31	58.5	32	84.2	11	78.6	

Table 9

Fish and duck consumption for Phase II study participants, by group

	Tribal members		Volunteers		Fishing licensees		P value
	n	%	n	%	n	%	
Number of fish-containing meals eaten per week in August, 1986							
0	22	41.5	9	23.7	5	35.7	0.06
< 1	21	39.6	23	60.5	6	42.9	
1 - 2	4	7.	6	15.8	3	21.4	
3	6	11.3	0		0		
Number of fish-containing meals eaten per week when most available							
0	11	20.8	0		1	7.1	0.05
< 1	21	39.6	14	36.8	7	50.1	
1 - 2	14	26.4	15	39.5	5	35.7	
3 - 6	7	13.2	9	23.7	1	7.1	
Number of 8-inch fish eaten per meal							
0	11	20.8	1	2.7	0		0.02
≤ 2.5	19	35.9	19	51.4	10	71.4	
> 2.5	23	43.4	17	46.0	4	28.6	
Number of duck-containing meals eaten per week in August, 1986							
0	51	96.2	37	97.4	13	92.9	0.75
≥ 1	2	3.8	1	2.6	1	7.1	
Number of duck-containing meals eaten per week when most available							
0	39	73.6	24	63.2	11	78.6	0.88
≥ 1	14	26.4	14	36.8	3	21.4	

Table 10

Laboratory results for Phase II study participants, by group

	Tribal members		Volunteers		Fishing licensees		P value
	Geometric mean	SD	Geometric mean	SD	Geometric mean	SD	
Blood lead (ug/dl)	6.3	1.8	5.7	1.5	3.8	1.8	0.01
(n)	(51)		(38)		(14)		
Blood cadmium (ng/ml)	0.7	0.9	0.5	2.7	0.3	2.8	0.06
(n)	(51)		(38)		(14)		
Urine cadmium (ng/ml)	0.2	1.4	0.2	3.3	0.2	3.4	0.54
(n)	(52)		(37)		(14)		
Urine cadmium, adjusted (ug/g creatinine)	2.0	3.3	2.3	3.6	2.3	3.2	0.86
(n)	(52)		(36)		(14)		
Erythrocyte protoporphyrin (ug/dl)	22.6	1.3	20.7	1.2	18.9	1.4	0.06
(n)	(51)		(38)		(14)		

Table 11

Odds ratios and 95% confidence intervals for blood lead levels among Phase II study participants

Risk Factor	≤ 5.4 ug/dl	> 5.4 ug/dl	Odds ratio	95% CI
	n	n		
Fish meals/week in August, 1986				
0	19	16	1.0	
< 1	28	21	0.9	0.4 - 2.2
1 - 3	6	13	2.6	0.8 - 8.3
Fish meals/week when most available				
0	7	4	1.0	
< 1	22	20	1.6	0.4 - 6.3
1 - 2	19	14	1.3	0.3 - 5.4
3 - 6	5	12	4.2	0.8 - 20.9
No. of fish/serving				
0	7	4	1.0	
≤ 2.5	29	18	1.1	0.3 - 4.3
> 2.5	17	27	2.8	0.7 - 10.7
Duck meals eaten in August, 1986				
0	51	48	1.0	
≥ 1	2	2	1.1	0.1 - 7.9
Duck meals eaten when most available				
0	39	34	1.0	
≥ 1	14	16	1.3	0.6 - 3.1

Table 12

Odds ratios and 95% confidence intervals for urine cadmium levels among Phase II study participants

Risk Factor	≤ 0.2 ng/mL	> 0.2 ng/mL	Odds ratio	95% CI
	n	n		
Fish meals/week in August, 1986				
0	20	14	1.0	
< 1	22	28	1.8	0.8 - 4.4
1 - 3	3	16	7.6	1.9 - 31.2
Fish meals/week when most available				
0	8	4	1.0	
< 1	18	22	2.4	0.6 - 9.4
1 - 2	15	19	2.5	0.6 - 10.0
3 - 6	4	13	6.5	1.3 - 32.4
No. of fish/serving				
0	7	4	1.0	
≤ 2.5	18	29	2.8	0.7 - 10.8
> 2.5	19	25	2.3	0.6 - 8.9
Duck meals eaten in August, 1986				
0	45	54	1.0	
≥ 1	0	4	7.5	0.4 -143.3
Duck meals eaten when most available				
0	35	37	1.0	
≥ 1	10	21	2.0	0.8 - 4.8

Table 13

Odds ratios and 95% confidence intervals for blood cadmium levels among Phase II study participants

Risk Factor	≤ 0.5 ng/mL	> 0.5 ng/mL	Odds ratio	95% CI
	n	n		
Fish meals/week in August, 1986				
0	17	18	1.0	
< 1	28	21	0.7	0.3 - 1.7
1 - 3	8	11	1.3	0.4 - 4.0
Fish meals/week when most available				
0	5	6	1.0	
< 1	22	20	0.8	0.2 - 2.9
1 - 2	17	16	0.8	0.2 - 3.1
3 - 6	9	8	0.7	0.2 - 3.5
No. of fish/serving				
0	5	6	1.0	
≤ 2.5	27	20	0.6	0.2 - 2.5
> 2.5	21	23	1.9	0.2 - 3.5
Duck meals eaten in August, 1986				
0	52	47	1.0	
≥ 1	1	3	3.3	0.4 -29.6
Duck meals eaten when most available				
0	38	35	1.0	
≥ 1	15	15	1.1	0.5 - 2.6

Table 14
Odds ratios and 95% confidence intervals for urine cadmium levels adjusted for creatinine among Phase II study participants

Risk Factor	≤ 2.4 ug/g creatinine	> 2.4 ug/g creatinine	Odds ratio	95% CI
	n	n		
Fish meals/week in August, 1986				
0	20	14	1.0	
< 1	27	22	1.2	0.5 - 2.8
1 - 3	6	13	3.1	1.0 - 10.0
Fish meals/week when most available				
0	9	3	1.0	
< 1	21	19	2.7	0.7 - 11.3
1 - 2	17	16	2.8	0.7 - 12.1
3 - 6	6	11	5.5	1.1 - 27.6
No. of fish/serving				
0	7	4	1.0	
≤ 2.5	24	22	1.6	0.4 - 6.3
> 2.5	21	23	1.9	0.5 - 7.5
Duck meals eaten in August, 1986				
0	53	45	1.0	
≥ 1	0	4	10.6	0.6 -201.9
Duck meals eaten when most available				
0	40	32	1.0	
≥ 1	13	17	1.6	0.7 - 3.9

Table 15

Results of logistic regressions on lead and cadmium levels
controlling for other covariables* for participants in Phase II (n= 81)

Dependent variable	Independent variable	Regression coefficient	Std error	P value
Blood lead	Age	0.875	0.354	0.01
	Sex	2.393	0.689	0.0005
	Study group	-1.346	0.518	0.009
	Occupation	3.169	1.167	0.007
	Duck last month	-4.456	2.246	0.047
Blood cadmium	Age	1.083	0.311	0.0002
	Smoking	3.067	0.825	0.0002
Urine cadmium	Age	0.762	0.276	0.006
	Smoking	1.550	0.653	0.018
	Fish last month	1.232	0.434	0.005
	Duck last month	0.762	0.182	0.000
Urine cadmium, adjusted for creatinine	Age	0.645	0.239	0.007

* See Table 2 and Methods for definition

Table 16

Laboratory results for Phase III study participants by group

	Tribal members		Volunteers		Fishing licensees		P value
	Geometric mean	SD	Geometric mean	SD	Geometric mean	SD	
Blood lead (ug/dl)	4.6	3.2	2.5	2.8	4.6	1.5	0.27
(n)	(13)		(15)		(5)		
Blood cadmium (ng/ml)	1.1	2.9	0.6	1.9	0.6	3.0	0.24
(n)	(13)		(15)		(5)		
Urine cadmium (ng/ml)	0.5	2.1	0.3	3.0	1.0	4.2	0.10
(n)	(13)		(14)		(5)		
Urine cadmium, adjusted (ug/g creatinine)	0.07	3.4	0.03	3.9	0.07	6.0	0.21
(n)	(12)		(13)		(5)		
Erythrocyte protoporphyrin (ug/dl)	24.3	1.4	20.8	1.2	18.3	1.6	0.57
(n)	(13)		(15)		(5)		

Table 17

Comparison of Phase II and Phase III laboratory results

	Phase II		Phase III		P value
	Geometric mean	SD	Geometric mean	SD	
Blood lead (ug/dl)	6.1	1.7	3.5	2.8	0.001
Blood cadmium (ng/ml)	0.6	2.5	0.8	2.5	0.25
Urine cadmium (ng/ml)	0.3	3.2	0.4	2.9	0.12
Urine cadmium, adjusted (ug/g creatinine)	3.2	3.3	0.05	4.1	0.0001
Erythrocyte protoporphryrin (ug/dl)	21.7	1.4	20.5	1.3	0.06

Table 18

Comparison of fish and duck consumption reported in Phase II and Phase III

	Phase II		Phase III		P Value
	n	%	n	%	
Fish meals/week in the last month					
0	7	21.9	3	9.4	0.13
< 1	13	40.6	20	62.5	
1 - 3	12	37.5	9	28.1	
Fish meals/week when most available					
0	0		1	3.0	0.45
<1	0		5	15.2	
1 - 2	20	60.6	21	63.6	
3 - 6	13	39.4	6	18.2	
No. fish/serving					
≤ 2.5	15	46.9	17	51.5	0.11
> 2.5	17	53.1	16	48.5	
Duck meals eaten last month					
0	30	90.9	45	93.9	0.64
≥ 1	3	0.1	4	6.1	

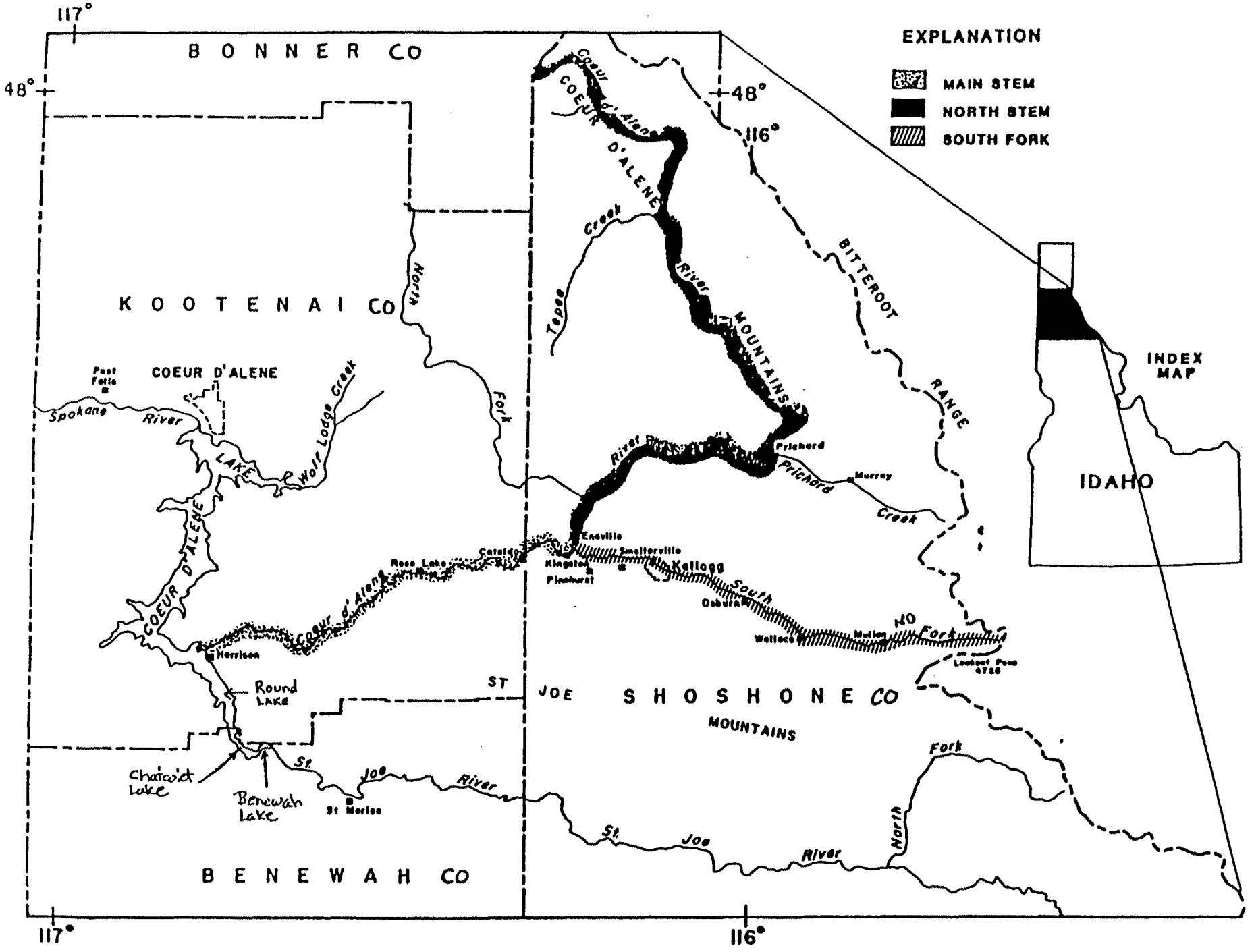
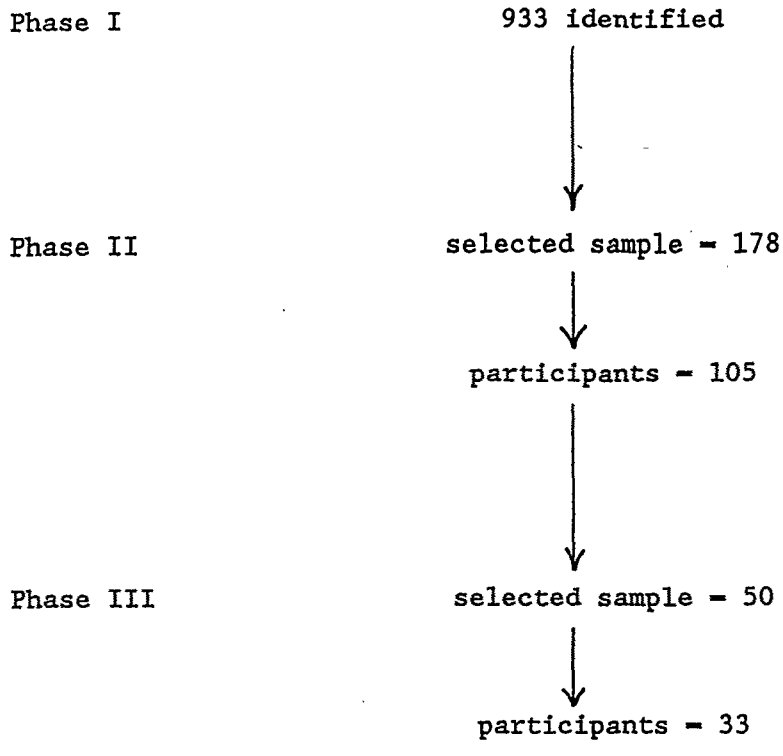


Figure 1 Map of Coeur D'Alene

Figure 2

Participant selection sequence



Attachment 1

HOUSEHOLD IDENTIFICATION NUMBER : : : : : : : (1-6)

Interview Number : : : (7-8)

Date of Interview : : : : : : : : : (9-14)

Address: (Street) : : : : : : : : : : : : : : : : : : : (15-31)

(City) : : : : : : : : : : : : : : : : : : : (32-48)

(State) : : : (49-51) : : : : : : : (52-57)

Hello, my name is (your name), and I am working with (-The Panhandle District Health Department/ or /The Indian Health Service). We are collecting information from residents of the Coeur d'Alene area about foods they eat. The (-Panhandle District Health Department/ or /Coeur d'Alene Tribal Council) and other residents have expressed concern that foods from the river and lake may contain excess amounts of lead and cadmium. This questionnaire will help us determine if a problem exists.

I would like to speak to the person who prepares most of the meals for this family. Who would that be? (This person should be at least 18 years of age.)

If the food preparer is not the informant, ask:

Is he (or she) at home?

If "yes", ask:

May I speak with him/her?

If "no", or unavailable, ask for an appointment to return for interview or ask for phone number to call for an appointment.

Name of food preparer(s): Phone:

_____ _____ _____

When the food preparer is available, reintroduce yourself by repeating the opening paragraph, then say:

> I would like to ask you a few questions about your family and the foods they eat. Answering all of the questions should take about 10 minutes. I would appreciate a few minutes of your time to answer these questions. You may stop or choose not to answer a question at any time. Your responses will be kept confidential.

Would you be willing to participate? 1. ___ yes 2. ___ no

If "yes", continue with interview.

I. GENERAL INFORMATION

1. What is your name?

(last) : (58-75)

(first) : : : : : : : : : : : : : : : (76-86) Middle Initial : : (87)

2. What is the household's telephone number?

(telephone number): . . . - . . . . . (88-94)

If there is no telephone in household, ask:

3. Is there another telephone at which you can be reached?

(telephone number): : : : - : : : : : (95-101)

4. What is the best time of day to reach you by telephone?

1. ___ Morning 2. ___ Afternoon 3. ___ Evening

II. DEMOGRAPHIC INFORMATION

1. Are you an enrolled member of a Native American Tribe? 1. ___Yes
   2. ___No (7)

2. Where is your permanent residence?

   1. ___ On the Coeur d'Alene Tribal Reservation
   2. ___ City of Coeur d'Alene and areas north of Interstate 90
   3. ___ Area south of Round Lake
   4. ___ Area east of Lake Coeur d'Alene
   5. ___ Area west of Lake Coeur d'Alene
   6. ___ Outside of Kootenai and Benewah Counties (8)

3. Does your household serve meals containing fish? 1. ___Yes
   2. ___no (9)

INTERVIEWER: If "yes", go to question 4.
If "no", go to question 9.

4. In the last 2 months on average, how often have you served meals containing fish? (If fish is eaten more than once a day, count all meals separately.)

   1. ___ Less than one time per week
   2. ___ One to two times per week
   3. ___ Three to six times per week
   4. ___ Seven to ten times per week
   5. ___ 11-14 times per week
   6. ___ More than 14 times per week (10)

5. Do you eat fish that come from:

A. Lake Coeur d'Alene only (exclude Benewah, Round and Chatcolet Lakes)	1 ___ yes	2 ___ no	(11)
B. Lakes north of Lake Coeur d'Alene	1 ___ yes	2 ___ no	(12)
C. The chain lakes and the Coeur d'Alene rivers	1 ___ yes	2 ___ no	(13)
D. Benewah, Round and Chatcolet Lakes, and the St. Joe's, St. Maries and other streams emptying into Lake Coeur d'Alene	1 ___yes	2 ___ no	(14)
E. All other lakes, rivers and streams	1 ___yes	2 ___ no	(15)

6. From these fishing lakes, which one do you fish at the most? Second most? Third most? Fourth most? The least?

   1. Lake Coeur d'Alene only (Exclude: Benewah Round and Chatcolet Lakes)
   2. Lakes north of Lake Coeur d'Alene
   3. The chain lakes and the Coeur d'Alene River
   4. Benewah, Round and Chatcolet lakes, and the St. Joe's, St. Maries and other streams emptying into Lake Coeur d'Alene
   5. All other lakes, rivers and streams

Fish most often	: :	(16)
Second most	: :	(17)
Third most	: :	(18)
Fourth most	: :	(19)
Least	: :	(20)

Interviewer: If respondent indicated "no" to any number of the lakes/streams in question 6, enter "9" in that number of blanks in this ranking. For example, if they did not fish at only one of the lakes, enter "9" under "least". If they did not fish at two of the lakes, enter "9" under "fourth most" and under "least".

7. Do you serve the following fish?

A. Kokanee, blue backs, trout, chinook, white fish	1 ___yes 2 ___no	(21)
B. Perch, crappie, bass, pike	1 ___yes 2 ___no	(22)
C. Catfish, bull heads, suckers	1 ___yes 2 ___no	(23)

8. Which of these fish groups do you serve most often? Second most? Third most?

   1. Kokanee, blue backs, trout, chinook, white fish
   2. Perch, crappie, bass, pike
   3. Catfish, bull heads, suckers

Fish most often	: :	(24)
Second most	: :	(25)
Third most	: :	(26)

9. Does your household serve meals containing ducks or geese shot in Kootenai or Benewah counties?

1__yes 2__no 3___not sure (27)

Interviewer: If "yes", go to question 10. If "no", go to question 11.

10. When local ducks or geese are available, how many times per week do you serve them? If they are eaten more than once a day, count all meals separately.

1 ___ Less than 1 time per week
2 ___ One to 2 times per week
3 ___ Three to 6 times per week
4 ___ Seven to 10 times per week
5 ___ 11-14 times per week
6 ___ More than 14 times per week (28)

11. Does your household serve locally grown water potatoes?

1___yes 2___no 3___not sure (29)

Interviewer: If "yes",go to question 12. If "no", go to question 13.

12. When water potatoes are in season, how often do you serve them? If water potatoes are eaten more than once a day, count all meals separately.

1 ___ Less than 1 time per week
2 ___ One to 2 times per week
3 ___ Three to 6 times per week
4 ___ Seven to 10 times per week
5 ___ 11-14 times per week
6 ___ More than 14 times per week (30)

13. Does your household serve locally harvested wild rice:

1___yes 2___no 3 ___not sure (31)

Interviewer: If "yes",go to question 14. If "no", go to question 15.

14. When wild rice is available, how often do you serve meals containing wild rice? If wild rice is eaten more than once a day, count all meals separately.

1 ___ Less than 1 time per week
2 ___ One to 2 times per week
3 ___ Three to 6 times per week
4 ___ Seven to 10 times per week
5 ___ 11-14 times per week
6 ___ More than 14 times per week (32)

15. In which month of the year do members of this household eat the largest amount of:

Interviewer: If respondent has already indicated that fish, ducks/geese, water potatoes and/or wild rice are not served in the household, write 99 in the space provided for that food item. Otherwise, enter the appropriate month from the following code list:

01 = January	05 = May	09 = September
02 = February	06 = June	10 = October
03 = March	07 = July	11 = November
04 = April	08 = August	12 = December

A. Fish : : : (33-34)

B. Ducks and/or geese : : : (35-36)

C. Water potatoes : : : (37-38)

D. Wild rice : : : (39-40)

Interviewer: For the next three questions, please enter number of fish eaten as the number of whole and half fish eaten. Do not enter smaller fractions of fish. To indicate a half fish, enter .5.

16. For all men in this household, ages 12 years or older, what is the average amount of fish usually eaten in a meal serving. Please estimate this serving size by telling us how many 8 inch fish they could eat during a meal. If they eat only a portion of an 8 inch fish (say half of an 8 inch fish), please indicate that portion.

: : : . : : (41-44)

17. For all women in this household, ages 12 years or older, what is the average amount of fish usually eaten in a meal serving. Please estimate this serving size by telling us how many 8 inch fish they could eat during a meal. If they eat only a portion of an 8 inch fish (say half of an 8 inch fish) please indicate that portion.

: : : . : : (45-48)

18. For all male and female children in this household younger than 12 years of age, what is the average amount of fish usually eaten in a meal. Please estimate this serving size by telling us how many 8 inch fish they could eat during a meal serving. If they eat only a portion of an 8 inch fish (say half of an 8 inch fish) please indicate that portion.

: : : . : : (49-52)

Interviewer: Record all responses to question 19 on the attached sheets.

19. For each person (including yourself) who has lived in this household for at least 6 months, over the last one year, I would like to ask the following information:

    a. Starting with the oldest household member, what is his/her name?

    b. How old is he/she? (If person is less than one year old, enter -1.)

    c. (Circle the code for "sex", ask if necessary)

    d. Over the last one year, how many months has this person lived in this household?

    e. How many years has (name) lived in Benewah and/or Kootenai counties?

Interviewer: If respondent has already indicated that fish, ducks/geese, water potatoes and/or wild rice are not served in the household, mark not applicable and go on to next food item.

    f. Does (name) eat fish?
    1. ___ Seldom
    2. ___ Most times
    3. ___ Not applicable

    g. When fish are most available, how often does (name) eat meals containing fish?
    1. ___ Less than 1 time per week
    2. ___ One to 2 times per week
    3. ___ Three to 6 times per week
    4. ___ Seven to 10 times per week
    5. ___ 11-14 times per week
    6. ___ More than 14 times per week
    7. ___ Not applicable

    h. Does (name) eat ducks and/or geese?
    1. ___ Seldom
    2. ___ Most times
    3. ___ Not applicable

i. When ducks and/or geese are most available, how often does (name) eat meals containing them?

1. ___ Less than 1 time per week
2. ___ One to 2 times per week
3. ___ Three to 6 times per week
4. ___ Seven to 10 times per week
5. ___ 11-14 times per week
6. ___ More than 14 times per week
7. ___ Not applicable

j. Does (name) eat water potatoes?

1. ___ Seldom
2. ___ Most times
3. ___ Not applicable

k. When water potatoes are most available, how often does (name) eat meals containing them?

1. ___ Less than 1 time per week
2. ___ One to 2 times per week
3. ___ Three to 6 times per week
4. ___ Seven to 10 times per week
5. ___ 11-14 times per week
6. ___ More than 14 times per week
7. ___ Not applicable

l. Does (name) eat wild rice?

1. ___ Seldom
2. ___ Most times
3. ___ Not applicable

m. When wild rice is most available, how often does (name) eat meals containing it?

1. ___ Less than 1 time per week
2. ___ One to 2 times per week
3. ___ Three to 6 times per week
4. ___ Seven to 10 times per week
5. ___ 11-14 times per week
6. ___ More than 14 times per week
7. ___ Not applicable

PERSON ID #:	A. NAME (last) (first) (middle initial)	B. AGE	C. SEX	D. MONTHS IN THIS HOUSEHOLD OVER LAST 12 MONTHS	E. TOTAL YEARS IN BONNER+ KOOTENAI COUNTIES
01 (53)	_____ _____ (mi) __	___ (yrs) (54-55)	1 M 2 F (56)	___ (mo) (57-58)	___ (yrs) (59-60)
02 (73)	_____ _____ (mi) __	___ (yrs) (74-75)	1 M 2 F (76)	___ (mo) (77-78)	___ (yrs) (79-80)
03 (93)	_____ _____ (mi) __	___ (yrs) (94-95)	1 M 2 F (96)	___ (mo) (97-98)	___ (yrs) (99-100)
04 (113)	_____ _____ (mi) __	___ (yrs) (114-115)	1 M 2 F (116)	___ (mo) (117-118)	___ (yrs) (119-120)
05 (133)	_____ _____ (mi) __	___ (yrs) (134-135)	1 M 2 F (136)	___ (mo) (137-138)	___ (yrs) (139-140)
06 (153)	_____ _____ (mi) __	___ (yrs) (154-155)	1 M 2 F (156)	___ (mo) (157-158)	___ (yrs) (159-160)
07 (173)	_____ _____ (mi) __	___ (yrs) (174-175)	1 M 2 F (176)	___ (mo) (177-178)	___ (yrs) (179-180)
08 (193)	_____ _____ (mi) __	___ (yrs) (194-195)	1 M 2 F (196)	___ (mo) (197-198)	___ (yrs) (199-200)
09 (213)	_____ _____ (mi) __	___ (yrs) (214-215)	1 M 2 F (216)	___ (mo) (217-218)	___ (yrs) (219-220)
10 (233)	_____ _____ (mi) __	___ (yrs) (234-235)	1 M 2 F (236)	___ (mo) (237-238)	___ (yrs) (239-240)
11 (253)	_____ _____ (mi) __	___ (yrs) (254-255)	1 M 2 F (256)	___ (mo) (257-258)	___ (yrs) (259-260)
12 (273)	_____ _____ (mi) __	___ (yrs) (274-275)	1 M 2 F (276)	___ (mo) (277-278)	___ (yrs) (279-280)
13 (293)	_____ _____ (mi) __	___ (yrs) (294-295)	1 M 2 F (296)	___ (mo) (297-298)	___ (yrs) (299-300)
14 (313)	_____ _____ (mi) __	___ (yrs) (314-315)	1 M 2 F (316)	___ (mo) (317-318)	___ (yrs) (319-320)

ID #:	EAT FISH	MEALS FISH PER WK?	EAT DUCKS/ GEESE (DU/ GE) WEEK?	MEALS DU/GE PER WEEK?	EAT BAKER POTATO?	MEALS BAKER POTATO /WK?	EAT WILD RICE?	MEALS WILD RICE /WK?
01	1__Sel 2__MaTi 3__NA(61)	| | | (62-63)	1__Sel 2__MaTi 3__NA(64)	| | | (65-66)	1__Sel 2__MaTi 3__NA(67)	| | | (68-69)	1__Sel 2__MaTi 3__NA(70)	| | | (71-72)
02	1__Sel 2__MaTi 3__NA(81)	| | | (82-83)	1__Sel 2__MaTi 3__NA(84)	| | | (85-86)	1__Sel 2__MaTi 3__NA(87)	| | | (88-89)	1__Sel 2__MaTi 3__NA(90)	| | | (91-92)
03	1__Sel 2__MaTi 3__NA(101)	| | | (102-103)	1__Sel 2__MaTi 3__NA(104)	| | | (105-106)	1__Sel 2__MaTi 3__NA(107)	| | | (108-109)	1__Sel 2__MaTi 3__NA(110)	| | | (111-112)
04	1__Sel 2__MaTi 3__NA(121)	| | | (122-123)	1__Sel 2__MaTi 3__NA(124)	| | | (125-126)	1__Sel 2__MaTi 3__NA(127)	| | | (128-129)	1__Sel 2__MaTi 3__NA(130)	| | | (131-132)
05	1__Sel 2__MaTi 3__NA(141)	| | | (142-143)	1__Sel 2__MaTi 3__NA(144)	| | | (145-146)	1__Sel 2__MaTi 3__NA(147)	| | | (148-149)	1__Sel 2__MaTi 3__NA(150)	| | | (151-152)
06	1__Sel 2__MaTi 3__NA(161)	| | | (162-163)	1__Sel 2__MaTi 3__NA(164)	| | | (165-166)	1__Sel 2__MaTi 3__NA(167)	| | | (168-169)	1__Sel 2__MaTi 3__NA(170)	| | | (171-172)
07	1__Sel 2__MaTi 3__NA(181)	| | | (182-182)	1__Sel 2__MaTi 3__NA(184)	| | | (185-186)	1__Sel 2__MaTi 3__NA(187)	| | | (188-189)	1__Sel 2__MaTi 3__NA(190)	| | | (191-192)
08	1__Sel 2__MaTi 3__NA(201)	| | | (202-203)	1__Sel 2__MaTi 3__NA(204)	| | | (205-206)	1__Sel 2__MaTi 3__NA(207)	| | | (208-209)	1__Sel 2__MaTi 3__NA(210)	| | | (211-212)
09	1__Sel 2__MaTi 3__NA(221)	| | | (222-223)	1__Sel 2__MaTi 3__NA(224)	| | | (225-226)	1__Sel 2__MaTi 3__NA(227)	| | | (228-229)	1__Sel 2__MaTi 3__NA(230)	| | | (231-232)
10	1__Sel 2__MaTi 3__NA(241)	| | | (242-243)	1__Sel 2__MaTi 3__NA(244)	| | | (245-246)	1__Sel 2__MaTi 3__NA(247)	| | | (248-249)	1__Sel 2__MaTi 3__NA(250)	| | | (251-252)
11	1__Sel 2__MaTi 3__NA(261)	| | | (262-263)	1__Sel 2__MaTi 3__NA(264)	| | | (265-266)	1__Sel 2__MaTi 3__NA(267)	| | | (268-269)	1__Sel 2__MaTi 3__NA(270)	| | | (271-272)
12	1__Sel 2__MaTi 3__NA(281)	| | | (282-283)	1__Sel 2__MaTi 3__NA(284)	| | | (285-286)	1__Sel 2__MaTi 3__NA(287)	| | | (288-289)	1__Sel 2__MaTi 3__NA(290)	| | | (291-292)
13	1__Sel 2__MaTi 3__NA(301)	| | | (302-303)	1__Sel 2__MaTi 3__NA(304)	| | | (305-306)	1__Sel 2__MaTi 3__NA(307)	| | | (308-309)	1__Sel 2__MaTi 3__NA(310)	| | | (311-312)
14	1__Sel 2__MaTi 3__NA(321)	| | | (322-333)	1__Sel 2__MaTi 3__NA(334)	| | | (335-336)	1__Sel 2__MaTi 3__NA(337)	| | | (338-339)	1__Sel 2__MaTi 3__NA [illegible]	[illegible]42)

COEUR D'ALENE FOLLOW-UP LEAD AND CADMIUM SURVEY

HOUSEHOLD ID #:_ _ ___ ___ ___ (1-4) SUBJECT ID #: ___ (5)

I. DEMOGRAPHIC AND SOCIOECONOMIC INFORMATION

What is your name (your CHILD'S NAME)? _____

What is your address? _____

_____ zip _____

1. Over the last one year, how many months have you (has -NAME-) lived in this household? ___ ___ (6-7)

2. Have you (Has -NAME-) ever lived in Shoshone Cty? 1__Yes 2__No 3__Don't Know (8)

2A. If "Yes", how many years and months did you (did -NAME-) live in Shoshone County? (If less than one year, please enter 00.)

___ ___ years ___ ___ months (9-12)

2B. When did you (did -NAME-) live in Shoshone County last?

___ ___ 19___ ___ (13-16)
month year

3. What is your (your child's) date of birth? ___ ___-___ ___ 19___ ___.(17-22)

4. RACE: 1__White, not of Hispanic origin
2__Black, not of Hispanic origin
3__Hispanic
4__Native American or Alaskan
5__Asian or Pacific Islander
6__Other, Specify _____ (23)

II. POTENTIAL LEAD AND CADMIUM EXPOSURE SOURCES

5. I'm going to read you a list of different kinds of jobs that may expose people to lead and cadmium dust or vapors. (If participant is too young to work, go to question 6.)

   5A. Have you (Has -NAME-) ever worked as a (READ JOB TITLE BELOW--e.g. lead smelter worker)? (If "No", go to next job title.)

   IF "YES",

   5A1. How many total years and months did you work as a (JOB TITLE)? (If less than 1 year, enter 00)

   5A2. When was the last time you worked as a (JOB TITLE)?

Job Title	Have you worked in this job? 1=Yes, 2=No 3=Don't Know	How many years & months total?	Last time worked? (mo/yr)	
01 = lead smelter worker	1 2 3	__ __ __ __	__ __ 19__ __	(24-34)
02 = foundry worker	1 2 3	__ __ __ __	__ __ 19__ __	(35-45)
03 = zinc refinery worker	1 2 3	__ __ __ __	__ __ 19__ __	(46-56)
04 = mine worker	1 2 3	__ __ __ __	__ __ 19__ __	(57-67)
05 = battery mfg. worker	1 2 3	__ __ __ __	__ __ 19__ __	(68-78)
06 = pesticide mfg. worker	1 2 3	__ __ __ __	__ __ 19__ __	(79-89)
07 = paint maker	1 2 3	__ __ __ __	__ __ 19__ __	(90-100)
08 = painter	1 2 3	__ __ __ __	__ __ 19__ __	(101-111)
09 = plumber	1 2 3	__ __ __ __	__ __ 19__ __	(112-122)
10 = glass, enamel or ceramic maker	1 2 3	__ __ __ __	__ __ 19__ __	(123-133)
11 = metal treating, engraving or alloy worker	1 2 3	__ __ __ __	__ __ 19__ __	(134-144)
12 = welder or solderer	1 2 3	__ __ __ __	__ __ 19__ __	(145-155)
13 = other lead-related industry worker	1 2 3	__ __ __ __	__ __ 19__ __	(156-166)
14 = sewage treatment worker	1 2 3	__ __ __ __	__ __ 19__ __	(167-177)
15 = other cadmium-related industries	1 2 3	__ __ __ __	__ __ 19__ __	(178-188)

COMMENTS: _____

6. Now I am going to ask you about jobs that other members of this household have held.

6A. Has another household member ever worked as a (READ JOB TITLE BELOW--e.g. lead smelter worker)? (If more than one household member has held a particular job title, enter one household member under the job title listed below, and any additional household members holding that same job title in the blank spaces on the following page.) (If "No", go to next job title.)

IF "YES":

6A1. How many total years and months did he/she work as a (JOB TITLE)? (If less than one year, enter 00.)

6A2. When was the last time he/she worked as a (JOB TITLE)? (Mo/Yr)

6A3. How is this person related to you (CHILD'S NAME)? (Enter code)

1 = mother 3 = father 5 = sister 7 = brother
2 = son 4 = daughter 6 = other relative 8=non-relative

Job Title	Have you worked in this job? 1=Yes, 2=No 3=Don't Know	How many years & months total?	Last time worked? (mo/yr)	Relation	
01 = lead smelter worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(189-200)
02 = foundry worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(201-212)
03 = zinc refinery worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(213-224)
04 = painter	1 2 3	__ __ __ __	__ __ 19__ __	__	(225-236)
05 = battery mfg. worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(237-248)
06 = pesticide mfg. worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(249-260)
07 = paint maker	1 2 3	__ __ __ __	__ __ 19__ __	__	(261-272)
08 = painter	1 2 3	__ __ __ __	__ __ 19__ __	__	(273-284)
09 = plumber	1 2 3	__ __ __ __	__ __ 19__ __	__	(285-296)
10 = glass, enamel or ceramic maker	1 2 3	__ __ __ __	__ __ 19__ __	__	(297-308)
11 = metal treating, engraving or alloy worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(309-320)
12 = welder or solderer	1 2 3	__ __ __ __	__ __ 19__ __	__	(321-332)
13 = other lead-related industry worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(333-344)
14 = sewage treatment worker	1 2 3	__ __ __ __	__ __ 19__ __	__	(345-356)
15 = other cadmium-related industries	1 2 3	__ __ __ __	__ __ 19__ __	__	(357-368)

COMMENTS: _____

7. Enter household members holding duplicate job titles in the spaces provided below.

Job Title Code	Have worked in this job? 1=Yes, 2=No 3=Don't Know	How many years & months total?	Last time worked? (mo/yr)	Relation	
__ __	1 2 3	__ __ __ __	__ __ 19__ __	__	(369-380)
__ __	1 2 3	__ __ __ __	__ __ 19__ __	__	(381-392)
__ __	1 2 3	__ __ __ __	__ __ 19__ __	__	(393-404)
__ __	1 2 3	__ __ __ __	__ __ 19__ __	__	(405-416)

COMMENTS: _____

III. HOBBIES:

8. Thinking about the kinds of hobbies that you have participated in over the last three months, have you: (1 = Yes, 2 = No, 3 = Don't Know)

1 2 3	A.	Painted pictures with artists paint	(417)
1 2 3	B.	Painted parts of the house or furniture	(418)
1 2 3	C.	Worked with stained glass	(419)
1 2 3	D.	Cast lead into fishing sinkers, bullets or anything else?	(420)
1 2 3	E.	Soldered?	(421)
1 2 3	F.	Made pottery and/or glazed pottery at home?	(422)

9. Thinking about the kinds of hobbies that household members have participated in over the last three months, have anyone: (1 = Yes, 2 = No, 3 = Don't Know)

1 2 3	A.	Painted pictures with artists paint	(423)
1 2 3	B.	Painted parts of the house or furniture	(424)
1 2 3	C.	Worked with stained glass	(425)
1 2 3	D.	Cast lead into fishing sinkers, bullets or anything else?	(426)
1 2 3	E.	Soldered?	(427)
1 2 3	F.	Made pottery and/or glazed pottery at home?	(428)

IV. FOOD CONSUMPTION HABITS:

10. When food is served, is it ever served in homemade or imported clay pottery or ceramic dishes? 1__Yes 2__No 3__Don't Know (429)

11. During the last month, how often have you (has -NAME) eaten meals containing fish?
1__less than 1 time per week 4__seven to 10 times per week
2__one to 2 times per week 7__not applicable
3__three to 6 times per week (430)

12. When fish are most available, how often do you (does -NAME) eat meals containing fish?
1__less than 1 time per week 4__seven to 10 times per week
2__one to 2 times per week 7__not applicable
3__three to 6 times per week (431)

13. During the last month, how often have you (has-NAME) eaten meals containing ducks/geese
(1) less than 1 time per week 4__seven to 10 times per week
2__one to 2 times per week 7__not applicable
3__three to 6 times per week (432)

14. When ducks and geese are most available, how often do you (does -NAME) eat meals containing them?
(1) less than 1 time per week 4__seven to 10 times per week
2__one to 2 times per week 7__not applicable
3__three to 6 times per week (433)

15. In which month of the year do members of this household eat the largest amount of: (Enter the appropriate month from the following code list.)

01 = January	03 = March	05 = May	07 = July	09 = September	11 = Novembe
02 = February	04 = April	06 = June	08 = August	10 = October	12 = Decembe

15A. Fish ___ ___ 15B. Ducks and/or geese ___ ___ (434-437)

16. Please estimate the usual amount of fish you eat (-NAME- eats) during a meal by telling me how many 8 inch fish you eat (-NAME- eats) during a meal. If you eat (-NAME- eats) only a portion of an 8 inch fish (say half of an 8 inch fish) please indicate that portion. ___ ___ ___ (438-441)

17. What is the highest grade or year of regular school that (NAME OF HOUSEHOLD HEAD) finished and got credit for?
(1) less than 8th grade 3__high school grad 5__4-year college degree
2__some high school 4__some college 6__graduate work 9__unknown (442)

18. Do you currently smoke cigarettes? 1__Yes (2) No (443)

18A. If "No", have you ever smoked? (1) Yes 2__No (444)

19. Which of the statements in List 1 comes closest to the total family income for this family before taxes in 1985?
1__under $5,000 8__refused
(2) $5,000 or more but less than $15,000 9__don't know or unknown
3__more than $15,000 (445)

(To interviewer): Fish meals only include wild-caught fish by the participant, family or friends, not fish purchased in stores.

HOUSEHOLD ID #: ___ ___ ___ ___ (1-4) SUBJECT ID #: ___ (5)

DEMOGRAPHIC & SOCIOECONOMIC INFORMATION

What is your name (your CHILD'S NAME)? _____

What is your address? ___ _____, _____
___ _____zip_____

FOOD CONSUMPTION HABITS

1. During the last one week, how many fish meals have you (has -NAME-) eaten? ___ ___ (6-7)

2. During the last one month, how often have you (has -NAME-) eaten meals containing fish?
1__less than 1 time per week 4__seven to 10 times per week
2__one to 2 times per week 5__more than 10 times per week
3__three to 6 times per week 7__not applicable (8)

3. When fish are most available, how often do you (does -NAME-) eat meals containing fish?
1__less than 1 time per week 4__seven to 10 times per week
2__one to 2 times per week 5__more than 10 times per week
3__three to 6 times per week 7__not applicable (9)

4. In what month are fish most available? ___ ___ (10-11)
1=Jan, 2=Feb, 3=March, 4=April, 5=May, 6=June, 7=July, 8=August, 9=September, 10=October, 11=November, 12=December

5. During the last month, how often have you (has -NAME-) eaten meals containing duck/geese?
1__less than 1 time per week 4__seven to 10 times per week
2__one to 2 times per week 5__more than 10 times per week
3__three to 6 times per week 7__not applicable (11)

6. Please estimate the usual amount of fish you eat (-NAME- eats) during a meal. If you eat (-NAME- eats) only a portion of an 8 inch fish (say half of an 8 inch fish) please indiate that portion.
(Interviewer: only record in whole or half fish)
___ . ___.___ (12-13)

Attachment 2

LAKE COEUR d'ALENE, IDAHO CADMIUM & LEAD STUDY

CASE 86-0030

SPECIMEN COLLECTION AND SHIPPING PROTOCOL

Division of Environmental Health Laboratory Sciences
Center for Environmental Health
Centers for Disease Control
Atlanta, Georgia 30333

Prepared: 08/06/86

1960s

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1. INTRODUCTION

The proper collection processing, storage and shipment of physiologic specimens from participants in the Lake Coeur d'Alene, Idaho Cadmium and Lead study is critical to the success of the study. The following sections describe the procedures which must be followed for all specimen collections. These procedures must be strictly adhered to in order to avoid contamination, loss, or degradation of the specimens. Please familiarize yourself with the study protocol and insure that you understand the concept of the study, the role of all of the personnel involved, and your own role.

Note that subjects are to report to the clinic in a fasting state and this will require that blood collection be accomplished early in the visit to avoid discomfort to the subject and an adverse impact on compliance. Blood and urine collection must be completed and processed under carefully controlled conditions of good laboratory practice. Blood separation and processing must be accomplished promptly to avoid degradation of the specimen.

It is extremely important that all records associated with each subject be maintained in an organized and complete manner to ensure that all information is properly collected and accurate. Specimens should be labeled promptly and processed as a unit or "run" and precautions must be taken to avoid patient - specimen - label - record mixups. This type of error is usually the most common error in the laboratory setting, but careful planning and a well organized work area will keep such errors at a minimum. Some of the information required for the specimen label and shipping list will be collected at the time of specimen collection. Problems in blood and/or urine collection should be noted in the sample log and in the comments section of the shipping list.

II. URINE COLLECTION AND PROCESSING (See protocol flowchart on page 14)

A. COLLECTION PROCEDURE

1. Materials needed per participant.

   - Urine collection cup (250 mL, plastic, sterile)
   - Small Zip-lock bag
   - Preprinted label

2. Preparation of urine collection cup for participant.

   - Remove the cup and cap from its plastic wrapping being careful not to dislodge the cap or touch the inside of the container or cap.

   - Seal the cap on the container and affix the participant's preprinted label marked "URINE CONTAINER" and write their name on the label using a ballpoint pen.

3. Instructions for urine collection.

   - The following instructions should be explained to the participant prior to urine collection.

     . Hands should be washed with soap and water.

     . The collection cup should not be opened until just before voiding.

     . The person should leave the cap turned up while voiding, then recap the filled container immediately.

     . IT IS MOST IMPORTANT that the inside of the container and the cap not be touched or come into contact with any parts of the body or clothing or external surfaces. Exposure to air should be minimized.

     . The participant should deliver the capped specimen immediately to the clinic personnel.

4. FIELD BLANK (If urine collection is done at single site)
   - Follow instructions for urine collection above to avoid contamination (e.g., hand washing, precautions to avoid contamination of container).
   - After every 19th participant, pour approximately 50 ml of deionized water provided into a 250 ml collection container.
   - Cap and affix a preprinted Field Blank label "FIELD BLANK-CONTAINER".
   - Using a ballpoint pen, add the date collected and your initials to the label.
   - Field Blank should be processed later in the same manner as participants urine samples collected that day (e.g., pour 10 ml deionized water from the 250 ml collection container into a 15 ml conical tube with purple dot).

B. PROCESSING PROCEDURE

1. Materials and equipment needed per participant.

   - 15 mL Conical-bottom plastic tube (no additive) (1)
   - 15 mL Conical-bottom plastic tube with purple dot (1)
   - 15 mL Conical-bottom plastic tube with red dot (containing 1 mL glycerol) (1)
   - Powder-free lab gloves
   - Safety glasses
   - Lab apron
   - Laboratory hood
   - Deionized water
   - Ultrapure concentrated nitric acid (G. Frederick Smith Chemical Co., Columbus, Ohio 43223, Catalogue No. 63, ultrex grade, or equivalent)
     Pipettor (Gilson Pipetman or other precision adjustable pipettor capable of dispensing 100 µL:Biorad BR-33 clear (metal-free) disposable pipet tips capable of containing 100 µL, or equivalent)
   - Racks
   - Preprinted labels
   - Freezer (-20°C)

2. Special safety precautions.

   - Nitric Acid - Special care should be taken when handling and dispensing the concentrated acid, since it is a caustic chemical capable of severe eye or skin damage. Wear a lab apron, powder-free gloves, and safety glasses. If the nitric acid comes in contact with any part of the body, quickly wash with copious quantities of water for at least 15 minutes.

3. - Preparation of laboratory blanks.

   . Wearing protective clothing and working under a hood, prepare one cadmium laboratory blank for each day on which urine specimens are processed.

   . Select one of the 15 mL plastic tubes labeled with a purple dot and slowly add 10 mL ± 1 mL of deionized water. Then carefully aliquot 100µL of nitric acid with the pipettor.

   . Cap, label with the preprinted label "LAB BLANK-CD", seal, and invert the tube five times.

   . On each label and using a ballpoint pen, write the date collected and the initials of the laboratory technician preparing the lab blanks. Freeze the blanks in an upright position at -20°C and store them frozen until shipment to CDC with the urine specimens.

4. Processing (specimen).

- Wear powder-free lab gloves, safety glasses, and work over a laboratory sink.

- Using a ballpoint pen, add the date collected to the "URINE CONTAINER" label.

- Using the preprinted labels provided for each participant, label each of the plastic tubes as follows:

Size/Type Bottle	Bottle Label
● 15 mL plastic (nitric acid)	85-0030-0001-T1 "UR CADMIUM"
● 15 mL plastic (glycerol)	85-0030-0001-T2 "URINE GGT/AAP"
15 mL plastic (no preservative)	85-0030-0001-U1 "UR NAGA/CREAT"

- Use a ballpoint pen to add the date collected and your initials to the labels on all tubes.

- Gently swirl the specimen in the capped collection container to resuspend any solids.

- Immediately after mixing, pour the proper quantity of urine into each plastic tube and use the correct aliquoting priority as shown in the protocol flowchart on page 14.

- Cap and tightly seal each tube.

- Dissolve preservative in the "URINE GGT/AAP" tube by gently mixing 30 times on the mixer.

5. Addition of acid preservatives.

- Addition of nitric acid to CADMIUM TUBES ONLY. (15 ml conical with purple dot).

NOTE: RINSE OUTSIDE OF PIPET TIP WITH DISTILLED WATER BEFORE USE.

. While working under a hood and wearing protective unpowdered gloves, apron and safety glasses, use a pipettor to rinse a pipet tip with nitric acid. Using the same tip aliquot 100 µL into each of the 15-mL conical-bottom tubes containing the participant's urine which will be used for cadmium analyses. Process one tube at a time, removing the cap, adding the acid, and replacing and tightly screwing the cap. Do not touch the interior of the cap or tube or place the cap or pipet tip on external surfaces which may be contaminated for trace elements. Change the tip each time it becomes contaminated. Invert the tubes gently 5 times and freeze immediately at -20°C.

6. Processing (Field Blank).

. Obtain one of the conical-bottom tubes labeled with a purple dot.

. Affix a preprinted Field Blank label "FIELD BLANK-CD".

- Pour 10 mL ± 1 mL of deionized water from 250 ml container, labeled Field Blank-CONTAINER, into the tube to the graduation mark. Then carefully add 100 µL nitric acid, recap and mix as for urine specimens.

- Using a ballpoint pen, add the date collected and your initials to the label.

- Freeze the Field Blanks in an upright position at -20°C and store them frozen with the urine specimens until they are shipped to CDC.

III. BLOOD COLLECTION AND PROCESSING (See protocol flowchart on page 15)

A. COLLECTION PROCEDURE

1. Materials needed per participant.

   - Gauze sponges, sterile, individually wrapped 2x2" (2).
   - Alcohol wipe
   - Bandaid
   - 3 mL lavender-top vacutainer (2)
   - 20 gauge 1 1/2" needle, sterile
   - 23 guage butterfly (used for children in place of needle)
   - Luer adaptor (needed for use with butterfly)
   - Preprinted labels
   - Tourniquet
   - Vacutainer holder
   - refrigerator

2. Venipuncture procedure.

   - Locate a suitable table and chair for blood drawing and lay out blood collection supplies.

   - Locate the puncture site. Hold with 2 fingers on one side of the "alcohol wipe" so that only the other side touches the puncture site. Wipe the area in a circular motion beginning with a narrow radius and moving outward so as not to cross over the area already cleaned. Repeat with a second alcohol wipe.

   - Locate vein and cleanse in manner previously described, then apply the tourniquet. If it is necessary to feel the vein again, do so; but after you feel it, cleanse with alcohol prep again, and dry with a sterile gauze square.

   - Fix the vein by pressing down on the vein about 1 inch below the proposed point of entry into the skin and pull the skin taut.

   - Approach the vein in the same direction the vein is running, holding the needle so that it makes a 15° angle with the examinee's arm.

   - Push the needle, with bevel facing up, firmly and deliberately into the vein. If the needle is in the vein, blood will flow freely into the tube. If no blood enters the tube, probe for the vein until entry is indicated by blood flowing into the tube.

   - For collection, loosen the tourniquet immediately after blood flow is established and release entirely as the last tube fills.

   - Completely fill all the vacutainer tubes and then withdraw the needle with a slow but firm motion. To ensure accurate results, a minimum of 1.75 mL of blood must be drawn into the 3 mL lavender-top tube to provide the proper ratio of anticoagulant to blood.

- When the needle is out of the arm, press gauze firmly on the puncture. Heavy pressure as the needle is being withdrawn should be avoided because it may cause the sharp point of the needle to cut the vein.

- Have the examinee raise his arm (not bend it) and continue to hold the gauze in place for several minutes. This will help prevent hematomas.

- Invert the lavender-top tubes several times to ensure proper mixing.

- Report to the physician any reaction experienced by the participant during the venipuncture procedure.

- Label all tubes with the preprinted labels provided, and use a ballpoint pen to add the date collected and your initials to the label. The lavender-top tube should be affixed with the label showing the participant's ID number (e.g. 86-0030-0001-B1) and identified "BLOOD-PB/CD". The second lavender top tubes should be labeled with the corresponding labels marked "BLOOD-PB/CD" and showing the participant's ID number (e.g. 86-0030-0001-B2).

- Place a bandaid on the subject's arm.

B. PROCESSING PROCEDURE

- Place the lavender-top tubes upright in a rack in the refrigerator within 30 minutes after being drawn. Log in the specimens and keep refrigerated (not frozen) until picked up for shipment. For the lavender-top tube, note on the log sheet if a full draw is not obtained (minimum blood volume is 1.75 mL) or if the blood tube was not refrigerated within 30 minutes.

IV. SHIPMENT OF SPECIMENS TO CDC, ATLANTA, GA.

A. BEGINNING OF STUDY AND GENERAL INSTRUCTIONS

- Determine the times 'FEDERAL EXPRESS' packages are picked up in order to connect with the best flights to Atlanta, Georgia. Shipments to Atlanta will be scheduled weekly and scheduled only Monday through Wednesday mornings. IMPORTANT: Since the materials packed in accordance with the instructions below will remain frozen (over dry ice) or cool (over cold packs) only about 2 1/2 days, shipments should not arrive in Atlanta on weekends or on Federal holidays.

- Inquire about regulations in your area concerning shipment of human blood, serum, and urine specimens with dry ice and the quantity of dry ice allowed per shipper. Also, make sure the specimens will be received at CDC within 24 hours.

- Maintain a supply of dry ice from a local supplier for shipping specimens each week. A block should be sawed at the plant into "1 slabs. Then each of these should be sawed lengthwise. A 7"x10" slab would fit easily into the shipper without having to break the slab. (Large pieces are preferable to small chunks, since they do not volatilize as rapidly.)

- Shipments of whole blood require a coolant to keep the materials cool during the shipment (NOT FROZEN). The laboratory techs should keep 10-12 coolant packs in the freezer at all times; replace the ones used weekly to maintain the inventory for other unexpected demands for these items.

- For all shipments, do not pack shippers with frozen specimens and dry ice or with whole blood and frozen coolant until just before shipment.

- Telephone the laboratory at CDC the day the shipment is mailed (404) 454-4300. Speak with Brenda Lewis, Carolyn Newman, or Jim Gill.

B. SPECIMEN SHIPPING LIST

- For each shipment, fill out a blank Specimen Shipping List provided by CDC. If the number of specimens in a shipment is too large to fit on one page, please use the continuation sheets provided. Please give the following information on the blank shipping lists (See attached example of a completed Specimen Shipping Lists):

  . Page number - e.g. 1 of 4
  . Shipment Number - number shipments sequentially starting with 1
  . No. frozen shippers - total number of shippers (containing frozen urine specimens) which are being mailed in this shipment.
  . No. refrigerated shippers - total number of shippers (containing refrigerated whole blood) which are being mailed in this shipment

. Type of Specimens - whole blood, serum, and/or urine
. No. of Specimens - number of each type of specimen shipped
. Name, Title, Signature, and Phone Number of person sending shipment or initials as indicated on the continuation sheets.
. Date Shipped
. Specimen ID for each participant - e.g. 86-0030-0001
. For each participant, check (✓) each individual specimen type/aliquot included in this shipment
. Date Collected - e.g. 111885
. Comments - Specify any deviations from collection, storage, and shipment protocols, and date of occurrence.

- Photocopy 2 extra copies of the completed shipping list. As will be described again later, the original will be shipped with the specimens, a copy mailed to CDC in a separate envelope, and a copy retained for your records.

C. FROZEN SPECIMENS

1. Materials needed per shipper

- 1 styrofoam shipper (each shipper will hold frozen specimens from approximately 10-12 participants)
- 10-12 lbs. dry ice
- 30-36 bubble-pack bags 4" x 7 1/2"
- Safety glasses or eye shield
- Strapping tape
- Gloves for handling dry ice and frozen specimens
- Sheets of bubble-pack packing material
- 'FEDERAL EXPRESS' label, preaddressed by Centers for Disease Control personnel
- DRY ICE label
- HUMAN BLOOD - THIS SIDE UP label
- CDC 'Specimen Shipping List' filled out
- Zip-lock bag
- Frozen urine specimens (3 urine tubes per participant)

2. Packing procedure.

- When packing the shippers, use gloves to handle the dry ice to avoid burning the hands. Glasses or an eye shield should also be worn if the dry ice cakes are to be broken into small pieces.

- Place the three frozen urine specimens from each participant in one 4" x 7 1/2" bubble bag and seal using the peel-off adhesive strip.

- Pack 10-12 sets of filled bubble bags upright in the bottom of the shipper. If necessary, use sheets of bubble-pack packing material to ensure the specimens vertical position.

- Put one layer of sheet bubble-pack material on top of the specimens.

- Fill the shipper with dry ice (probably will hold 10-12 lbs).

- Place more bubble material to even the top and place the polyfoam lid on top of the shipper.

- Insert the completed 'Specimen Shipping List' in a 12" x 12" Zip-lock bag and secure to the top of the polyfoam lid with filament tape. (Remember to photocopy two copies of the 'Specimen Shipping List'. Keep one copy for your records and mail the other copy in a separate envelope to the same CDC address listed below.)

- Secure the outer carton lid on the shipper with filament tape.

3. Shipping procedure.

- Cover or remove previous address labels on all shippers.

- Label each shipper with the following:

  . Preaddressed, 'FEDERAL EXPRESS' label with the following address:

    Brenda Lewis
    Chamblee, Building 32, Room 1502
    Centers for Disease Control
    4770 Buford Highway
    Chamblee, GA. 30341

  . DRY ICE label with the weight of dry ice added and words "UN-1845".

  . HUMAN BLOOD - THIS SIDE UP label

  . Write "ORM-A" and enclose in a red rectangle.

- Call the 'FEDERAL EXPRESS' office at 1-800-238-5355 to arrange for pick up.

- Telephone the laboratory at CDC the day the shipment is mailed (404) 454-4300. Speak with Brenda Lewis, Carolyn Newman, or Jim Gill.

D. REFRIGERATED SPECIMENS

1. Materials needed per shipper

- 1 styrofoam shipper
- 2 foam racks each capable of holding fifteen 3-mL vacutainer tubes
- 4 twenty-four oz. cold packs (frozen before shipment)
- 6 layers of bubble-pack
- Filament tape
- Gloves for handling frozen cold packs
- 'FEDERAL EXPRESS' label

- HUMAN BLOOD - THIS SIDE UP label
- KEEP REFRIGERATED - DO NOT FREEZE label
- Zip-lock bag
- Refrigerated blood specimens in 3-mL lavender top vacutainers

NOTE: Inventory of blood specimens should be included in 'specimen shipping list' enclosed with frozen specimens.

2. Packing procedure.

   - Place cold paks in a -20°C freezer the day before the shipment. Four 24 ounce packs will be needed for each shipper used. More cold packs may be needed if freezer does not attain -20°C. Up to 50 specimens can be shipped per shipper.

   - Working quickly, so that the blood will not be exposed to ambient temperature for more than 5 to 10 minutes, wrap up to 50 tubes with bubble-pack material; secure with tape.

   - Place two ice paks in the bottom of the shipper. Cover with bubble paper before adding wrapped specimens; add specimens and cover with additional bubble paper before adding two additional ice paks. Fill the shipper with additional bubble material and place the polyfoam lid on top of the shipper.

   - Secure the outer carton lid on the shipper with filament tape.

3. Shipping procedure.

   - Cover or remove previous address labels on all shippers.

   - Label each shipper with the following:

     . Preaddressed, 'FEDERAL EXPRESS' mailing label with the following address:

       Brenda Lewis
       Chamblee, Building 32, Room 1502
       Centers for Disease Control
       4770 Buford Highway
       Chamblee, GA 30341

     . HUMAN BLOOD-THIS SIDE UP label.

     . KEEP REFRIGERATED-DO NOT FREEZE label.

   - Call the 'FEDERAL EXPRESS' office at 1-800-238-5355 to arrange for pick-up Monday-Wednesday from noon-3:45 pm. Federal Express requires a one hour notice before the needed pickup.

   - Telephone the laboratory at CDC the day the shipment is mailed (404) 454-4300. Speak with Brenda Lewis, Carolyn Newman, or Jim Gill.

V. SPECIMEN TESTS

A. URINE TESTS

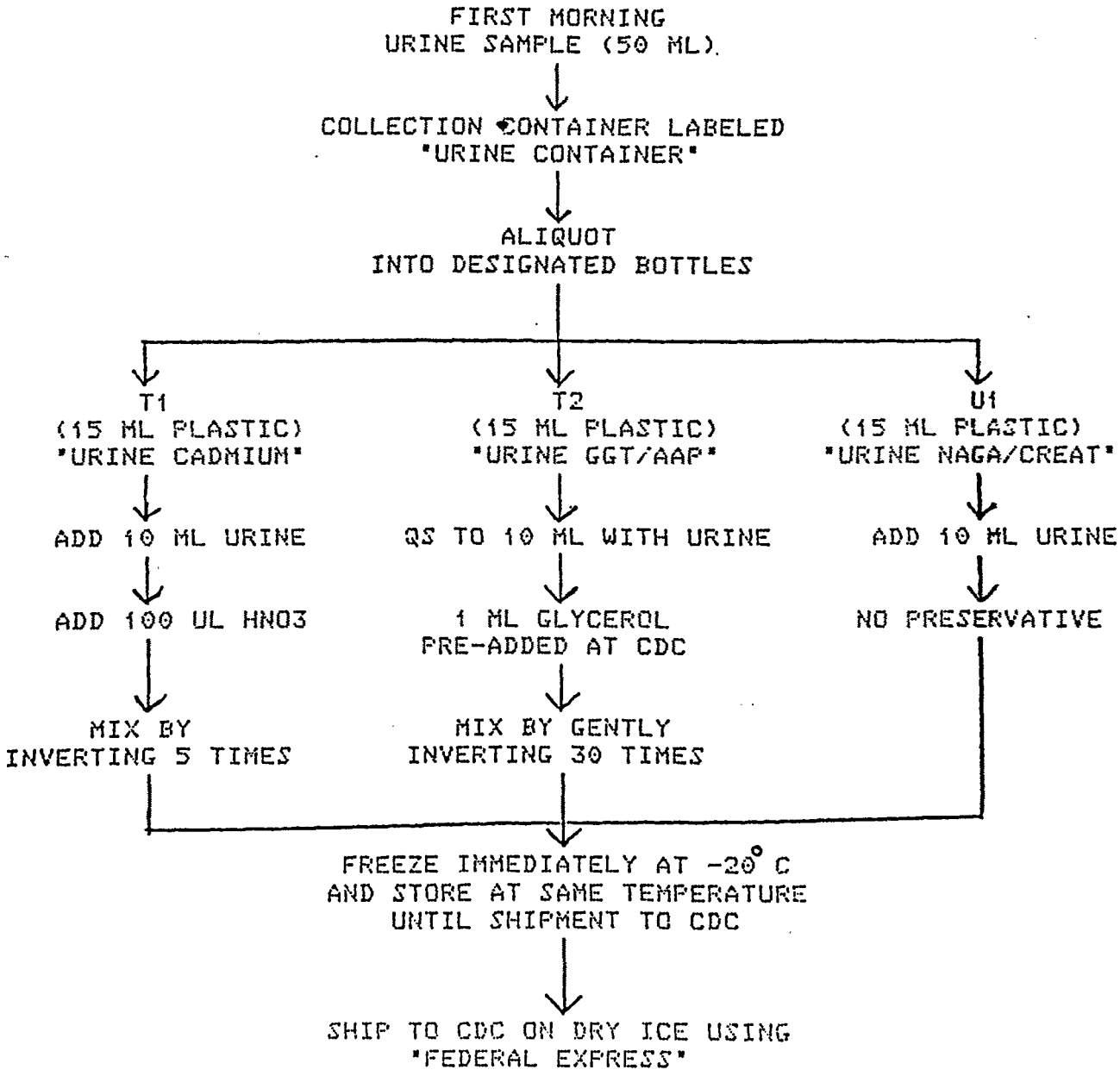
TEST NAME	TEST NAME ABBREVIATION	COLLECTION TYPE
N-Acetyl-B-Glucosaminidase	NAG ACTIVITY	urine
Creatinine	CREA	urine
Cadmium	CD	urine
Gamma glutamyl Transferase	GGT	urine
Alanine amino-Pepidase	AAP	

B. SERUM TESTS

TEST NAME	TEST NAME ABBREVIATION	COLLECTION TYPE
Lead	PB	Whole Blood
Cadmium	CD	Whole Blood
Free Erythrocyte Protoprophyrin	FEPR	Whole Blood

LAKE COEUR D'ALENE IDAHO
CADMIUM AND LEAD STUDY
CASE 86-0030

URINE COLLECTION AND PROCESSING PROTOCOL



* ALIQUOT EACH BOTTLE USING THE FOLLOWING PRIORITY:
  T1 (FIRST), T2 (SECOND), U1 (LAST)

NOTE: ALL ITEMS IN QUOTES AND UNDERLINED ARE "LABELS"

LAKE COEUR D'ALENE IDAHO
CADMIUM AND LEAD STUDY

CASE 86-0030

WHOLE BLOOD COLLECTION AND PROCESSING PROTOCOL

BLOOD (FASTING)

↓

TWO 3 ML
LAVENDER-TOP VACUTAINERS

↓

INVERT SEVERAL TIMES
TO ENSURE PROPER MIXING

↓

"BLOOD LEAD/CD"
B1

"BLOOD LEAD/CD"
B2

↓

REFRIGERATE AT 4°C WITHIN 30 MINUTES OF COLLECTION
AND STORE AT SAME TEMPERATURE
UNTIL SHIPMENT TO CDC

↓

SHIP TO STATE LAB

SHIP TO CDC ON ICE PAKS USING
"FEDERAL EXPRESS"

NOTE: ALL ITEMS IN QUOTES AND UNDERLINED ARE "LABELS"