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NSY PORTSMOUTH
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DEPARTMENT OF THE NAVY

NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
10 INDUSTRIAL HIGHWAY
MAIL STOP, #82
LESTER, PA 19113-2090

IN REPLY REFER TO

5090
Ser 1984/1823/dec

NOV 0 4 1993

Mr. Ernest Waterman, Project Coordinator
U.S. Environmental Protection Agency
Region I, Waste Management Section
JFK Federal Building
Boston, MA 02203-2211

Re: RCRA CORRECTIVE ACTION PROGRAM AT PORTSMOUTH NAVAL SHIPYARD; OFF-SHORE PUBLIC HEALTH AND ENVIRONMENTAL RISK EVALUATION (PHERE)

Dear Mr. Waterman:

Based on recent discussions on the off-shore human health risk assessment, enclosed is a summary of the analysis which was performed for the ingestion of lead in seafood as requested.

This summary is to explain the Navy's approach in calculating the risk assoicated with the ingestion of lead in seafood and how it is related to the algorithm presented in the Lead Uptake Biokinetic Model (UBK Model).

If you have questions or comments regarding this matter, please contact me at (215) 595-0567.

Sincerely,

Deanna Carlson

D. E. CARLSON
Remedial Project Manager
By direction of the Commanding Officer

Copy to:
MEDEP (N. Beardsley)
McLaren Hart (S. Urschel)
PNS (Code 121.5)

ANALYSIS OF HUMAN HEALTH RISKS FOR INGESTION OF LEAD IN SEAFOOD: PORTSMOUTH NAVAL SHIPYARD, KITTERY, ME

Introduction

Due to the fact that there are no USEPA-published critical toxicity values for lead, it is not possible to perform a quantitative risk estimate for lead exposures using standard USEPA methodology. Although the Lead Uptake Biokinetic Model (UBK Model), developed by USEPA, has been used in developing soil lead cleanup levels at hazardous waste sites, its usefulness in assessing acceptable lead concentrations in seafood has not been demonstrated. Furthermore, the UBK Model is designed to consider site-specific values for soil, air, and water, which are not available at this site for the sensitive population for seafood ingestion, which is the community at large. Default input values for these media are probably not appropriate for this population because the standard default values are relatively high, are higher than measured soil lead levels on-site or off-site, and therefore would not reflect site-specific conditions.

Therefore, for the purpose of this risk assessment, McLaren/Hart and E. Mahoney Associates have estimated children's blood lead levels using exposure assumptions derived from the Exposure Factors Handbook, and the "algorithm" presented in the UBK Model Technical Documentation publication for estimating blood lead levels from total lead uptake values. The results are presented, as in the Off-Shore Human Health Risk Assessment, Portsmouth Naval Shipyard, Kittery, ME, and a description of the analysis is provided below:

1. **Ingestion Rates**

Children, ages 0-6 years, are not expected to consume the same amount of food as a 70kg adult. The UBK Model (algorithm) is based on average body weights for 2-3 year olds.

Therefore, ingestion rates for children ages 0-6 years, were estimated using data presented in the Exposure Factors Handbook, page 2-34. Total fish consumption rates for children ages 0-9 years and for adults are presented. Children 0-9 years have consumption rates equal to 0.35 those of adults. Therefore this factor (0.35) was applied to the ingestion rates used for recreational and subsistence fishing for adults, which was used in estimating risks for all chemicals of potential concern in the Off-Shore Human Health Risk Assessment. This yielded ingestion rates for children of 0.019kg/day for recreational fishing and 0.133kg/day for subsistence fishing. The subsistence ingestion rate which we used (0.381kg/day) is approximately three-fold higher (more conservative) than the subsistence rate recommended by Region 1, which is 0.132kg/day. Therefore, our subsistence ingestion rates for children are estimated to be three-fold more conservative. In addition, both the children's recreational and subsistence ingestion rates are probably an additional two-fold more conservative because they represent rates for ages 0-9 years, whereas the model is designed for ages 0-6 years, and based on children 2 and 3 years of age. Therefore, subsistence ingestion rates are three to six times more conservative, and recreational ingestion rates are probably twice as high.

Enclosed is Table 5-52 taken from the Off-Shore Human Health Risk Assessment, which illustrates all exposure assumptions and results for ingestion of seafood for recreational and subsistence fishing of lobster, flounder, and mussels.

2. **GI Absorption Factor**

We used 0.29 which is the average of two values presented in the UBK Model Technical Documentation (0.15 and 0.42). This is less conservative than Region I (which prescribes 0.50) by a factor of 0.4.

3. **Ingestion Rates and GI Absorption Factor**

Our estimates of ingestion rates exceed (more conservative) Region I estimates by a factor of 3 to 6 times, and bioavailability rates are lower than Region I by a factor of 0.4. Therefore, overall, our estimates exceed Region I estimates by a factor of 1.2 to 2.4 times for total lead uptakes. This difference would not have any impact on the conclusions drawn relative to exposures resulting in elevated blood leads.

If a GI absorption factor of 0.5 had been used with Region 1 ingestion rates, then total daily lead uptakes would be as follows:

Species	Exposure Scenario	Total Lead Uptake ug/day	Predicted Children's Blood Levels ug/dl
Lobsters	Subsistence	2.77	<2.0
	Recreational	1.14	<2.0
Mussels	Subsistence	72.1	~27.0
	Recreational	29.6	<10.0
Flounder	Subsistence	2.08	<2.0
	Recreational	0.85	<2.0

If GI absorption factor of 0.5 had been used with our conservative ingestion rates, total daily lead uptakes would be as follows:

Species	Exposure Scenario	Total Lead Uptake ug/day	Predicted Children's Blood Levels ug/dl
Lobsters	Subsistence	7.98	<5.0
	Recreational	1.14	<2.0
Mussels	Subsistence	207.	>30.0
	Recreational	29.6	~10.0
Flounder	Subsistence	5.98	<5.0
	Recreational	0.85	<2.0

Both these examples probably overestimate total lead uptake because ingestion rates are based on estimates for children 0-9 years of age.

4. Chemical Concentrations

It should be noted that all estimates of lead uptakes for children were based on maximum measured lead concentrations in mussels, lobsters, and flounder. However, when utilizing the UBK Model, USEPA recommends using average measured chemical concentrations for lead in media of concern. Average values would result in significantly lower estimates for lead uptakes for all exposures. Average vs. maximum chemical concentrations are shown below:

	Average Lead Concentrations mg/kg	Maximum Lead Concentrations mg/kg
Mussels	1.03	3.12
Lobsters	0.04	0.12
Flounder	0.04	0.09

If average concentrations were used to estimate lead uptakes, all estimated blood leads would be reduced, and the lead uptakes for mussels would be reduced by three-fold. Using average concentrations and Region 1 values for ingestion rates and GI absorption rates, estimated lead uptakes for subsistence mussel ingestion would be 23.8, and blood lead levels would be below 10ug/dl, with 90% of the population below 10ug/dl. Based on those numbers there would be no risks associated with any seafood ingestion scenarios, under current or potential future use.

5. **Estimated Blood Lead Levels**

Children's blood lead levels were estimated using the "algorithm" presented in Figure 4-4 (page 4-20) of the UBK Vers 4.0 Technical Documentation. All values are predicted to fall below 10ug/dl, based on total uptakes below 20ug/day, except subsistence ingestion of mussels. Table 4-6 on page 4-26 of the UBK Technical Documentation indicates that at Lead uptakes below 20ug/day, more than 90% of the population would have blood lead levels below 10ug/dl. Numbers appearing above the line indicate the percent of the population with predicted blood leads below 10ug/dl.

6. **Conclusions**

The results of our analysis, as presented in the Off-Shore Human Health Risk Assessment, indicate that current lead levels in biota are not likely to pose any potential risks to children through ingestion. For lobster and flounder ingestion at subsistence and recreational rates as well as for recreational ingestion of mussels, 90% of children are predicted to have blood lead levels below 10ug/dl. However, elevated children's blood leads (above 10ug/dl) could result if mussels are eaten at subsistence levels, currently or in the future.

Additional analyses presented herein suggest that, if average concentrations are used, there are no risks under any current or future use conditions.

TABLE 5-52

LEAD UPTAKES RESULTING FROM INGESTION OF
LOBSTER, MUSSELS AND FLOUNDER
IN THE LOWER PISCATAQUA FOR
RECREATIONAL AND SUBSISTENCE FISHING

Species	Lead Concentrations mg/kg	Seafood Ingestion Rate kg/day	Exposure Scenario	GI Absorption Factor	Total Predicted Lead Uptake ~~mg~~ ug/day	Predicted Children's Blood Lead Levels ug/dl[1]
Lobsters	0.12	0.133	Subsistence	0.29	4.63	<5.0
	0.12	0.019	Recreational	0.29	0.66	<2.0
Mussels	3.12	0.133	Subsistence	0.29	120.3	>30.
	3.12	0.019	Recreational	0.29	17.2	<7.0
Flounder	0.09	0.133	Subsistence	0.29	3.47	<5.0
	0.09	0.019	Recreational	0.29	0.50	<2.0

(1) Estimated from Technical Support Document on Lead, USEPA ECAO-CIN-757, Sept. 1990, Figure 4-4. "Summary of Relationships Between Daily Lead Uptake and Blood Lead for Infants."

United States
Environmental Protection
Agency

Office of Health and
Environmental Assessment
Washington DC 20460

EPA 600/8-89/043
July 1989

Research and Development

EPA

Exposure Factors Handbook

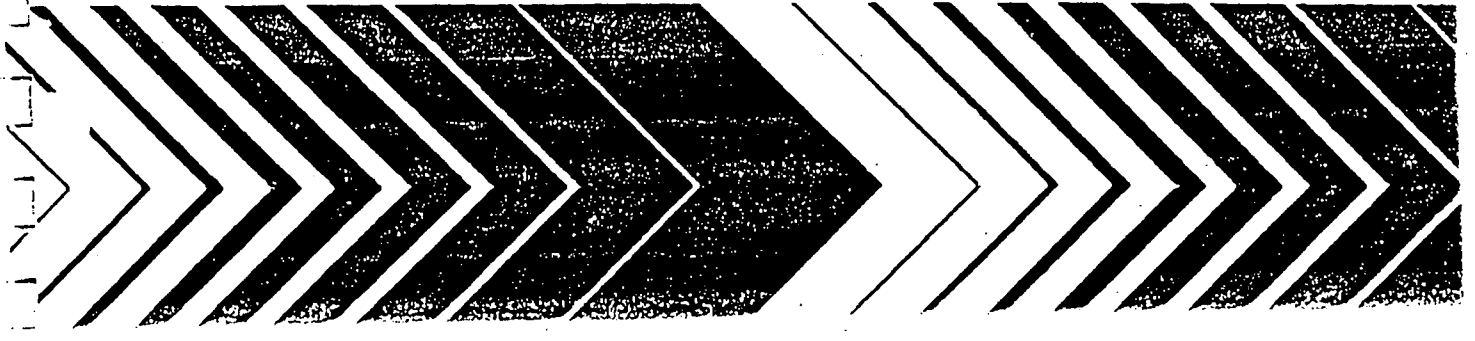

Table 2-15. Total Fish Consumption by Demographic Variables[a]

Demographic category	Consumption (g/person/day) Mean	Upper 95th percentile
Race		
Caucasian	14.2	41.2
Black	16.0	45.2
Oriental	21.0	67.3
Other	13.2	29.4
Sex		
Female	13.2	38.4
Male	15.6	44.8
Age (years)		
0- 9	6.2	16.5
10-19	10.1	26.8
20-29	14.5	38.3
30-39	15.8	42.9
40-49	17.4	48.1
50-59	20.9	53.4
60-69	21.7	55.4
70+	13.3	39.8
Census Region		
New England	16.3	46.5
Middle Atlantic	16.2	47.8
East North Central	12.9	36.9
West North Central	12.0	35.2
South Atlantic	15.2	44.1
East South Central	13.0	38.4
West South Central	14.4	43.6
Mountain	12.1	32.1
Pacific	14.2	39.6

[a] The calculations in this table are based on responses to a survey conducted by NPD Research, Inc. in which respondents were asked to report the species and amount consumed during the month in which the survey was conducted. NPD Research, Inc. estimates that these respondents represent, on a weighted basis, 94.0 percent of the population of U.S. residents.

Environmental Protection Agency

ECAO-CIN-757
September, 1990

A

Research and Development

TECHNICAL SUPPORT DOCUMENT ON LEAD

Prism 0,40

Prepared for

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE

Prepared by

Environmental Criteria and Assessment Office
Office of Health and Environmental Assessment
U.S. Environmental Protection Agency
Cincinnati, OH 45268

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NOTICE

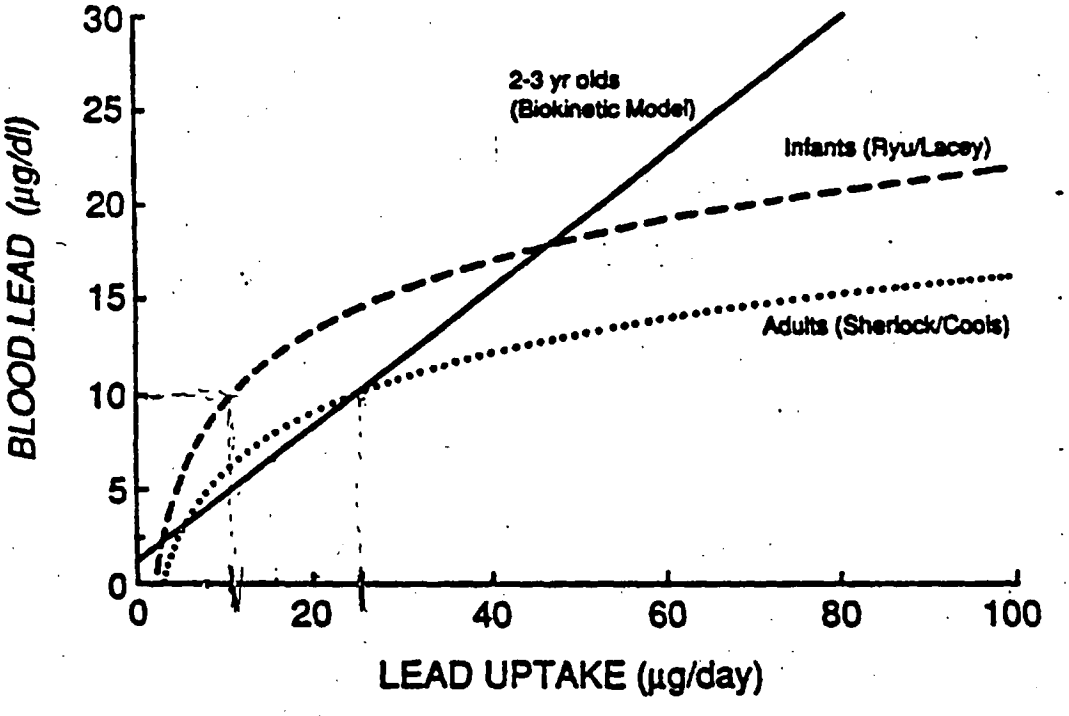

FIGURE 4-4

Summary of Relationships Between Daily Lead Uptake and Blood Lead for Infants (Ryu et al., 1983; Lacey et al., 1983), Adults (Sherlock et al., 1982; Cools et al., 1976) and 2- to 3-Year-Old Children, Derived From the Harley and Kneip (1985) Biokinetic Model.

Source: U.S. EPA, 1989a

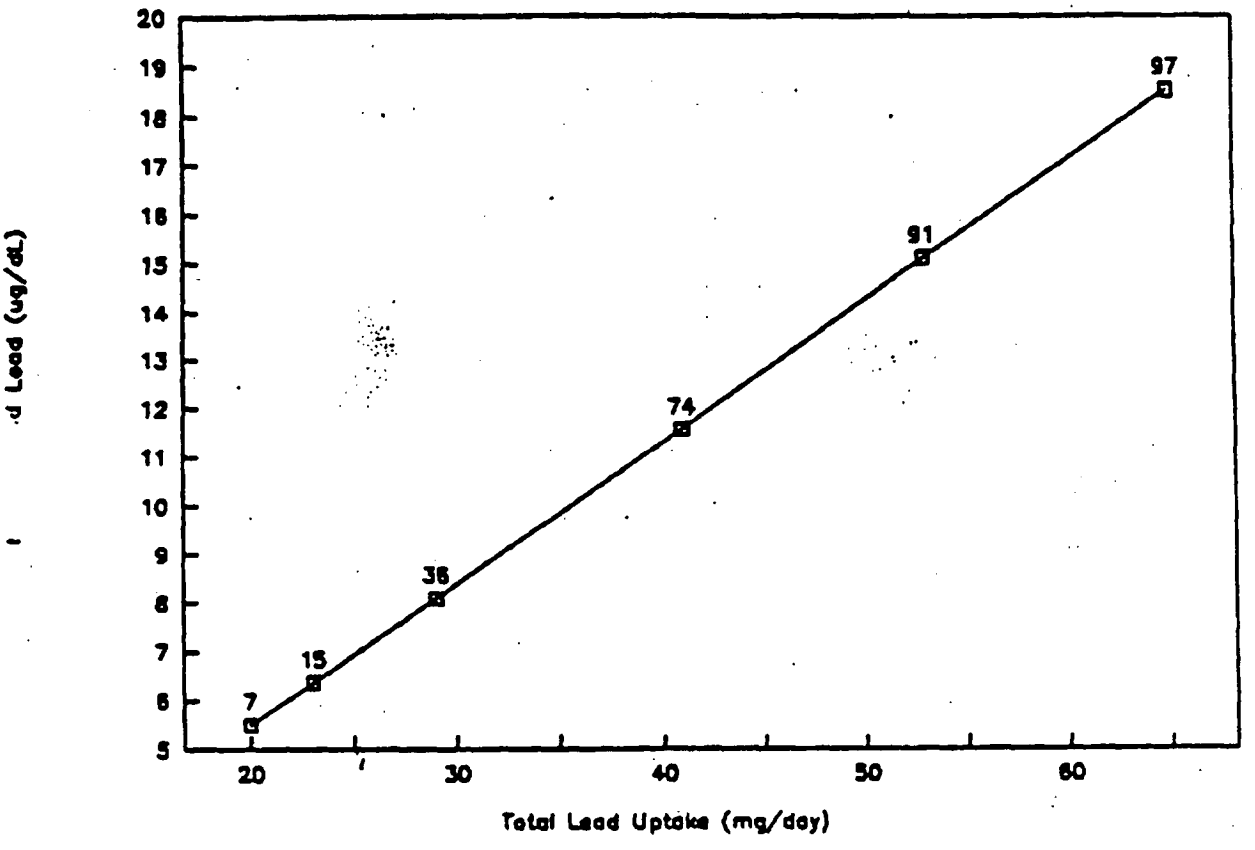

FIGURE 4-6

Mean Blood Lead Levels in 2-3 Year Old Children vs. Total Lead Uptake as Predicted by the Lead Biokinetic Model. Maternal blood lead was assumed to be 7.5 ug/dL. A Value of 1.42 was assumed for the GSD.