Health Consultation

AN EVALUATION OF CONTAMINANT CONCENTRATIONS IN FISH FROM YUBA RESERVOIR FOR 2003

YUBA RESERVOIR, JUAB AND SANPETE COUNTIES, UTAH

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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YUBA RESERVOIR, JUAB AND SANPETE COUNTIES, UTAH

Prepared by:

Utah Department of Health
Office of Epidemiology
Environmental Epidemiology Program
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Background and Statement of Issues

The Utah Department of Environmental Quality (UDEQ) is cooperating with the Environmental Protection Agency (EPA) in the *National Study of Chemical Residues in Lake Fish Tissue*. The National Fish Tissue Study is a survey of contamination in freshwater fish to estimate the national distribution of selected persistent, bioaccumulative and toxic chemicals in fish tissue from lakes and reservoirs of the contiguous United States (EPA 2004a). The objectives of the study are to provide a national estimate of mean concentration of 268 chemicals in lake fish, define a national baseline to track progress of pollution control activities, and identify where contaminant levels are high enough to warrant further investigation. Fish were collected from 500 lakes and reservoirs randomly selected from the estimated 270,000 lakes and reservoirs in the lower 48 states. The Division of Water Quality requested that the Environmental Epidemiology Program (EEP) review the fish sampling data from fish sampled from Utah lakes and reservoirs. Yuba Reservoir was one of the reservoirs selected for sampling as part of this national study.

Yuba Reservoir has a surface area of 10,905 acres with 34.8 miles of shoreline. It is located near highway I-15 in the middle of the state spanning Juab and Sanpete counties. Yuba State Park, located at the northern end of the reservoir has several camping and boating facilities. Yuba Reservoir has year-round fishing for species including: trout; walleye; perch; catfish; and northern pike.

Fish from Yuba Reservoir have been collected and analyzed for chemical contaminants. Fish were analyzed for a few heavy metals, volatiles, semivolatiles, PCBs, dioxins, and furans. Sampling site is shown in Figure 1. The Division of Water Quality requested that the Environmental Epidemiology Program review the data. This health consultation is an evaluation of chemical contaminants in fish from Yuba Reservoir in Utah covering the period of 2003.

Results

All contaminant concentrations are reported as a wet weight concentration in milligrams of contaminant per kg fish tissue (mg/kg). Fish tissue was analyzed as a composite of multiple fish of one species. Contaminant concentrations are for the analyzed composite, not individual fish; therefore, the reported values are average concentrations of the contaminant concentrations of all fish in the composite.

Five walleye and five common carp were collected from Yuba Reservoir. Walleye (a predatory fish species) and common carp (a non-predatory fish species) represent two different types of fish that are caught and consumed from Yuba Reservoir. Walleye were filleted and analyzed as a composite. Carp were homogenized whole prior to composite analysis. Mercury, dimethylarsinic acid, and PCBs were detected in Walleye (Table 1). Mercury, n-dodecane, twelve pesticides, and three dioxin/furans were detected in carp (Table 2). None of the chemicals detected are considered elevated for either species of fish tested.

Discussion

Screening values (SVs) were developed by the U.S. Environmental Protection Agency (EPA) and are used as standards by which levels of contamination can be compared. Screening values are defined as the concentrations of target analytes in fish tissue that are of potential public health concern. Screening values are used to establish the concentration in fish that can trigger further investigation and/or consideration of fish advisories for the waterbodies and species where such concentrations occur [EPA 2000b]. Non-carcinogen and carcinogen screening values are found in Tables 3 and 4. None of the chemicals detected exceeded the screening values for walleye or common carp from Yuba Reservoir. As no other species from Yuba Reservoir were tested, it is not known if contaminants such as mercury are elevated in other game fish.

Subsistence fishers have higher consumption rates of fish and therefore, higher levels of contaminants. Subsistence fishers are more likely to suffer from adverse health effects from eating contaminated fish. The EEP is not aware of people using Yuba Reservoir for subsistence fishing.

To determine whether people are exposed to contaminants related to a site, ATSDR evaluates the environmental and human components that lead to human exposure. This exposure pathways analysis consists of five elements and the exposure pathway can be completed or potential. The five exposure elements include: (1) a source of contamination, (2) transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) receptor population. In a completed exposure pathway, all five elements exist and indicate that exposure to a contaminant has occurred in the past, is occurring, or will occur in the future. Potential exposure pathways require that one of the five elements is missing, but may exist, and indicate that exposure to a contaminant may have occurred in the past, may be occurring, or may occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present [ATSDR 2005]. Since none of the chemicals detected are elevated for either species of fish tested, there is no completed pathway for exposure to people consuming fish from Yuba Reservoir.

Children's Health Considerations

The Agency of Toxic Substances and Disease Registry recognize the unique vulnerabilities of infants and children to environmental contaminants. Children are less developed and may have developmental harm from exposure that would not be experienced by a completely developed adult. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Children's health was considered as part of this health consultation.

Conclusions

Fish from Yuba Reservoir do not have levels of chemical contaminants that pose a human health hazard following consumption. Based on higher fish consumption rates, the potential for adverse

health effects is higher for those consuming fish at a subsistence level. The EEP is not aware of people using Yuba Reservoir for subsistence fishing.

Recommendations

The EEP recommends that concentrations of mercury, PCBs, pesticides and other chemicals be analyzed in other game fish from Yuba Reservoir.

Public Health Action Plan

The Environmental Epidemiology Program of the Utah Department of Health will continue to collaborate with the Utah Department of Environmental Quality, the Central Utah Public Health Department, and the Utah Division of Wildlife Resources to notify the public of the findings of this health consultation. A copy of this Health Consultation will be posted on the Environmental Epidemiology web site.

The Environmental Epidemiology Program will continue to collaborate with all applicable agencies to perform additional research on mercury, PCBs, and other chemical contaminants in fish in Utah. The Environmental Epidemiology Program will adjust recommendations as new information becomes available.

The Environmental Epidemiology Program will work with the Utah Department of Environmental Quality, Utah Division of Wildlife Resources and the Central Utah Public Health Department to monitor fishing at Yuba Reservoir to identify potential subsistence fisher populations affected by contaminants in fish from the reservoir.

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Certification

This Health Consultation, An Evaluation of Contaminant Concentrations in Fish From Yuba Reservoir for 2003, was prepared by the Utah Department of Health, Environmental Epidemiology Program under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with its findings.

Alan Yarbrough
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References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Public Health Assessment Guidance Manual (Update). January 2005.

Environmental Protection Agency. 2000a. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 1. Fish Sampling and Analysis; 3rd ed. Washington. Publication No. EPA 823-B-00-007.

Environmental Protection Agency. 2000b. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2. Risk Assessment and Fish Consumption Limits; 3rd ed. Washington. Publication No. EPA 823-B-00-008.

Environmental Protection Agency. 2004a. Fact Sheet: 2004 Update. The National Study of Chemical Residues in Lake Fish Tissue. Publication No. EPA-823-F-04-021. www.epa.gov/waterscience/fishstudy/

Figures and Tables

Figure 1. Location of sampling site on map of Utah.

Table 1. Sampling data for chemicals detected in walleye fillet composite samples from Yuba Reservoir, Utah (2003).

Analyte	Concentration (mg/kg)*	SCC Code†
Dimethylarsinic acid	0.107	NA
Mercury	0.117	NA
Total PCBs	0.00193	J

Fish samples collected by Utah Department of Environmental Quality.
* Wet weight concentrations of contaminants from composite analysis.
† J = Estimated value.

Table 2. Sampling data for chemicals detected in common carp homogenized composite samples from Yuba Reservoir, Utah (2003).

Analyte	Concentration (mg/kg)*	SCC Code†		
alpha-BHC	0.00619	J, RNF2		
gamma-BHC	0.00207	NA		
delta-BHC	0.00277	J		
n-Dodecane	0.12383	J		
Ethalfluralin	0.00182	RNF2		
Heptachlor	0.001986	J		
Mercury	0.185	NA		
4,4'-DDD	0.00078	J		
4,4'-DDE	0.01124	NA		
trans-Nonachlor	0.00204	J		
Oxychlordane	0.00365	J, RNF2		
Pentachloroanisole	0.00398	J, RNF2		
Pentachloronitrobenzene	0.00108	J		
Trifluralin	0.0322	NA		
Total Chlordane	0.00569	NA		
Total DDT	0.01202	NA		
Total PCBs	0.0188	B, J		
			TEF‡	**TEQ‡ (mg/kg)**
2,3,7,8-TCDD	4E-08	J	1	4E-08
2,3,4,7,8-PECDF	7E-08	J	0.5	3.5E-08
2,3,7,8-TCDF	5E-07	NA	0.1	5E-08
			Total TEQ =	1.25E-07

* Wet weight concentrations of contaminants from composite analysis.

† B = Blank contamination; J = Estimated value; RNF2 = Estimated value. Primary and confirmation column results not within a factor of 2.

‡ TEF = toxicity equivalency factor; TEQ = toxic equivalency concentration; See Appendix A for explanation of dioxin and dioxin-like compound toxicities.

Table 3. Non-carcinogen screening value calculations for chemicals detected.

Analyte	MRL/RfD (mg/kg/day)	Source	Screening Value (mg/kg)
alpha-BHC	0.008	Intermediate Oral MRL	32
gamma-BHC	0.0003	EPA RfD	1.2
Ethalfluralin	0.04	EPA RfD	160
Heptachlor	0.0005	EPA RfD	2.0
Mercury*	0.0001	EPA RfD	0.3
Pentachloronitrobenzene	0.003	EPA RfD	12
Trifluralin	0.0075	EPA RfD	30
Total Chlordane†	0.0005	EPA RfD	2.0
Total DDTs‡	0.0005	EPA RfD	2.0
Total PCBs§	0.00002	EPA RfD	0.08
Total TEQs	1E-09	Chronic Oral MRL	4E-06

MRL = Minimal Risk Level, RfD = Reference Dose
Health guidelines are not available for delta-BHC, dimethylarsinic acid, n-dodecane, and pentachloroanisole.
SVs based on body weights and fish consumption rates as described in Appendix B.
* Based on the chronic oral RfD for methylmercury.
† EPA considers chlordane the sum of chlordane, oxychlordane, and trans-nonachlor [EPA 2000b].
‡Based on the RfD for total DDT isomers of DDT, DDE, and DDD [EPA 2000a].
§ Total PCBs based on the RfD for Aroclor 1254.

Table 4. Carcinogen screening value calculations for chemicals detected.

Analyte	Oral Slope Factor $(mg/kg/day)^{-1}$	Screening Value (mg/kg)
alpha-BHC	6.3	0.0063
gamma -BHC	1.3	0.0307
Heptachlor	4.5	0.0089
Trifluralin	0.0077	5.2
Total Chlordane*	0.35	0.114
Total DDTs†	0.34	0.117
Total PCBs‡	2	0.02
Total TEQs	156000	2.56E-07

SVs based on body weights and fish consumption rates as described in Appendix B.

There are no EPA Oral Slope Factor values for the following detected chemicals: delta-BHC, dimethylarsinic acid, n-dodecane, ethalfluralin, mercury, pentachloroanisole, and pentachloronitrobenzene.

* EPA considers chlordane the sum of chlordane, oxychlordane, and trans-nonachlor [EPA 2000b].

† Based on EPA oral slope factor for DDT.

‡ Based on EPA oral slope factor for total PCBs.

Appendices

Appendix A

Dioxin and dioxin-like compound toxicities

TEF = toxicity equivalency factor
TEQ = toxic equivalency concentration

TEFs have been assigned to dioxins and dioxin-like compounds in order to compare the relative toxicity of each compound to that of TCDD. Toxicity equivalents (TEQs) are then calculated to assess the risk of exposure to a mixture of dioxin-like compounds. A TEQ is defined as the product of the concentration (C) of an individual compound and the corresponding TCDD toxicity equivalency factor (TEF):

TEQ = (C)*(TEF)

The total TEQs is the sum of all TEQs for each of the congeners in a given mixture [ATSDR 1998]. In this health consultation, the total TEQs are used to determine an SV for all dioxins and dioxin-like compounds detected.

Appendix B

Screening Value and Consumption Limit Calculations

For Noncarcinogenic Health Effects

$SV = [(MRL)(BW)]/CR$

SV = Screening value for a contaminant (in mg/kg or ppm)
MRL = Minimal risk level (in mg/kg/day)
BW = Mean body weight of the general population or subpopulation of concern (kg)
CR = Mean daily consumption rate of the species of interest by the general population or by the subpopulation of concern averaged over a 70-yr lifetime (in kg/day)

For Carcinogenic Health Effects

$SV_c = [(RL/SF)*BW]/CR$

SV_c = Screening value for a carcinogen (in mg/kg or ppm)
RL = Maximum acceptable risk level (1/100,000 dimensionless)
SF = Oral slope factor $(mg/kg/d)^{-1}$
BW = Mean body weight of the general population or subpopulation of concern (kg)
CR = Mean daily consumption rate of the species of interest by the general population or by the subpopulation of concern averaged over a 70-yr lifetime (in kg/day)