Letter Health Consultation

Evaluation of Mercury in Trout

DUCK VALLEY RESERVATION
IDAHO-NEVADA BORDER

OWYHEE COUNTY, IDAHO

MAY 23, 2008

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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An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

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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LETTER HEALTH CONSULTATION

Evaluation of Mercury in Trout

DUCK VALLEY RESERVATION
IDAHO-NEVADA BORDER

OWYHEE COUNTY, IDAHO

Prepared By:

Idaho Department of Health and Welfare
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

IDAHO DEPARTMENT OF
HEALTH & WELFARE

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April 29, 2008

RE: Evaluation of Mercury in Rainbow Trout from Reservoirs on the Duck Valley Reservation

John Crum
Water Quality Coordinator
Shoshone-Paiute Tribe
Duck Valley Reservation
P.O. Box 219
Owyhee, NV 89832

Dear Mr. Crum,

The Bureau of Community and Environmental Health, ATSDR Cooperative Agreement Program has completed an evaluation of mercury in rainbow trout from reservoirs on your tribe's reservation. Attached is the final evaluation with our conclusions and recommendations.

Best Regards,

Kai Elgethun PhD MPH
ATSDR Health Assessor
208-334-5682

LETTER HEALTH CONSULTATION
TITLE: Mercury in Fish from Reservoirs on the Duck Valley Reservation

Bureau of Community & Environmental Health (BCEH)
ATSDR Cooperative Agreement Program
Idaho Division of Health

Prepared by: Kai Elgethun
3 December 2007
Requested by: John Crum, Water Scientist, Shoshone-Paiute Tribes

BACKGROUND

The Duck Valley Reservation of the Shoshone-Paiute Tribes straddles the border between Idaho and Nevada. Recreational fishing is a significant economic boon to the tribe, who manage several reservoirs and lakes that are stocked with trout and who collect tribal fishing license fees. In the summer and fall of 2007, US Geological Survey (USGS) collected and analyzed rainbow trout from the tribe's supply hatchery, Black Canyon Hatchery near Grace, ID, and trout from the reservoirs on the reservation. Fish samples were filets of individual fish (rainbow trout). Total mercury was measured in these fish samples at the USGS mercury lab in Middleton, WI. In November 2007, the Bureau of Community & Environmental Health (BCEH) met with representatives from the tribe to discuss the results of this fish testing. At this time, tribal representatives asked BCEH to analyze the results and determine what limitations might be advised for fish consumption given the presence of mercury in fish.

DISCUSSION

Data Analyzed in This Report

Results for the Black Canyon Hatchery fish and fish from reservoirs on the reservation are included here. Because Wild Horse Reservoir is technically off-reservation and is in the state of Nevada, Idaho Division of Health BCEH cannot comment on these data.

Data Summary

Table 1 summarizes the fish mercury data received by BCEH on November 29. A geometric mean is used to express average values for each water body. The geometric mean is more representative of the central tendency of the data than the conventional arithmetic mean (which is what most people think of as the average). For each water body, the range and geometric mean with and without the highest data point is shown to illustrate whether or not a single high value is elevating the mean. The final health-based estimates (expressed as limited meals per month) include the highest data points.

Table 1. Mercury concentration in hatchery fish and fish in reservoirs on the Duck Valley Reservation

Water Body	Mercury (mg/kg wet weight)	
	Range	Geometric Mean
Hatchery	0.093-0.140	0.115
Hatchery (without highest point)	0.093-0.124	0.109
Mountain View	0.091-0.974	0.372
Mountain View (without highest point)	0.091-0.926	0.348
Billy Shaw	0.099-1.158	0.379
Billy Shaw (without highest point)	0.099-1.156	0.350
Sheep Creek	0.094-1.409	0.166
Sheep Creek (without highest point)	0.094-0.500	0.143

Bioavailability

Methylmercury constitutes over 99% of the total mercury detected in fish muscle tissue (fillet), with no detection of inorganic or dimethylmercury (Grieb et al. 1990; Bloom 1992). BCEH conservatively assumed that the total mercury values reported here (Table 1) to be all methylmercury. Methylmercury is the form of mercury most easily absorbed through the gastrointestinal tract (about 95% absorbed). Therefore, BCEH also assumed that the bioavailability of total mercury in fish was 100%.

Health Comparison Values

The Agency for Toxic Substances and Disease Registry (ATSDR) has developed a chronic oral minimal risk level (MRL) of 0.0003 milligram per kilogram per day (mg/kg/day) for methylmercury (ATSDR 1999). The U.S. Environmental Protection Agency (EPA) derived an oral reference dose (RfD) of 0.0001 mg/kg/day for methylmercury. The kg here refers to a person's body weight. For pregnant women and children who eat a subsistence diet (people eating at least one fish meal per day), at least one of the health comparison values is exceeded for fish from all of the water bodies, including the hatchery. For pregnant women and children who are recreational consumers of fish (approximately 2 meals per week), at least one of the health comparison values is exceeded for fish from Mountain View and Billy Shaw Reservoirs.

Estimation of Exposure & Limited Meals per Month

Table 2 shows the assumed body weight and fish meal size used in the calculations for this analysis. These are the values used by the Idaho Fish Consumption Advisory Project for all analyses.

Table 2. Parameters used in exposure and meal limit estimates

Population		Children [a]	Pregnant Women [b]	General Public
Body Weight [c]	**(kg)**	20	70	80
	(pound)	44	154	176
Meal Size Uncooked (oz) [d]		4	8	8

a: children 6 years old or younger
b: pregnant women, women planning to become pregnant, and nursing mothers
c: adjusted from Idaho Behavioral Risk Factors (BVRHS 2001)
d: 1 oz = 0.0283 kg; 4 oz = 0.1134 kg; 8 oz = 0.2268 kg

The equation below shows how the limited meals per month estimates are calculated. These meal estimates are used to convey risk of adverse health effects to the public and to provide guidelines to encourage fish consumption in moderation.

$$Meals / Month = \frac{\frac{RfD \times BW}{Conc} \times 30.44 days / mo}{MS}$$

where,
RfD: Reference Dose for methylmercury (0.0001 mg/kg/day)
BW: Body Weight (kg)
Conc: Fish tissue mercury concentration (mg/kg)
days/mo: Days per month
MS: Meal Size (kg)

Results

Table 3shows the number of meals recommended per month for fish from each of the water bodies.

Table 3. Recommended maximum number of fish meals per month

Water Body	Limited Meals per Month		
	Children [a]	Pregnant Women [b]	General Public [c]
Hatchery	8	8	28
Mountain View	2	2	8
Billy Shaw	2	2	8
Sheep Creek	5	5	20

a: children 6 years old or younger (body weight of 20 kg or 44 lbs)
b: pregnant women, women planning to become pregnant, and nursing mothers (body weight of 70 kg or 154 lbs)
c: body weight of 80 kg or 176 lbs
Meal Size: 4-ounce for children, 8-ounce for adults.

The greatest concern for mercury exposure exists at Mountain View and Billy Shaw Reservoirs, particularly for children 6 years old or younger, and pregnant women.

CONCLUSIONS

1. A *public health hazard* exists for children and pregnant women who eat more than two meals per month of rainbow trout from Mountain View and/or Billy Shaw Reservoirs.
2. A *public health hazard* exists for others in the general public who eat more than 8 meals per month of rainbow trout from Mountain View and/or Billy Shaw Reservoirs.
3. A *public health hazard* exists for children and pregnant women who eat more than 5 meals per month from Sheep Creek Reservoir.
4. It is unlikely that the general public will consume 20 or more fish meals per month from Sheep Creek reservoir, so it can be said that there is *no apparent public health hazard* present for this water body.
5. Hatchery fish planted on the reservation tested fairly high for mercury before entering the reservoirs there.

RECOMMENDATIONS

BCEH recommends the following actions:

- Shoshone-Paiute Tribes of Duck Valley should partner with USGS to issue a press release that includes the limited meals per month recommendations shown above. The press release should stress that fish are still a very food when eaten in moderation.
- Shoshone-Paiute Tribes of Duck Valley should post a sign at each reservoir that shows the limited meals per month recommendations.
- Shoshone-Paiute Tribes of Duck Valley should determine if hatchery fish that are lower in mercury can be obtained for future stocking of the reservoirs.

REFERENCES

Bloom NS. 1992. On the chemical form of mercury in edible fish and marine invertebrate tissue. Can J Fish Aquat Sci 49(5): 1010-1017.

Bureau of Vital Records and Health Statistics (BVRHS). 2001. Idaho Behavioral Risk Factors. Idaho Department of Health & Welfare, Boise, ID.

Grieb TM, Driscoll CT, Gloss SP, et al. 1990. Factors affecting mercury accumulation in fish in the upper Michigan peninsula. Environ Toxicol Chem 9: 919-930.

CERTIFICATION

The Health Consultation for the Duck Valley Reservation: Evaluation of Mercury in Rainbow Trout, Grace, Idaho, was prepared by the Idaho Department of Health and Welfare 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 health consultation was initiated.

Gregory V. Ulirsch
Technical Project Officer, CAT, CAPEB, DHAC
Agency for Toxic Substances and Disease Registry (ATSDR)

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Health Consultation and concurs with its findings.

Alan Yarbrough
Team Leader, CAT, CAPEB, DHAC, ATSDR