list

ATTACHMENT G

Selection of Fish Consumption Rates for the HHRA

In its analyses of fish consumption exposures for recreational anglers who may catch and consume fish from the Housatonic River, EPA has used fish consumption rates that are based on the Maine angler survey conducted by Ebert et al. (1993). To derive its rates, EPA has used statewide rates for all types of waterbodies combined (all waters) and has assumed that none of the fish brought into the household by survey participants was shared with other fish consumers within the household. In addition, EPA has assumed that the fish consumption rates of young children (aged 1 to 6 years) are approximately one-half of the fish consumption rates of adults. While GE supports the use of the Maine angler survey data as the basis for fish consumption rates in the HHRA, it does not support the application of the "all waters" fish consumption rates to the Housatonic River reaches evaluated and does not support the assumption that none of the fish were shared. In addition, GE believes that available fish consumption data for children indicate that a ratio of 40 percent should be used, instead of 50 percent, to estimate the fish consumption rates for young children, in the absence of age-specific data for sport-caught local fish. Each of these issues is discussed in this attachment.

Background

EPA has used an RME fish consumption rate of 32 g/day (equivalent to 52 meals per year) for adults for the river sections in Massachusetts and for consumption of warm water fish in Connecticut. This value is based on the Ebert et al. (1993) survey of Maine's freshwater anglers and represents the 90th percentile consumption rate for fish consumed from "all waters" in the state, assuming that there was no sharing of fish among family members. For consumption of trout in Connecticut, EPA has used a consumption rate of 14 g/day, based on the 90th percentile of the Ebert et al. (1993) values for fish consumed from rivers and streams, again assuming no sharing. Small children (aged 1 to 6 years) were assumed to eat fish at rates that were one-half the adult fish consumption rates, based on an assumption of sharing. It was assumed that 100 percent of the fish consumed during each year were obtained from the Housatonic River. Even assuming the absence of a fish consumption advisory, these assumptions are unrealistically high.

Assumption of No Sharing

EPA has assumed that no sharing occurs -- i.e., that the angler alone consumed every fish caught and brought into the house. EPA has selected these “no sharing” fish consumption rates based on a sensitivity analysis conducted by Ebert et al. (1993) using different assumptions about sharing. This sensitivity analysis was conducted as an acknowledgment that not all portion sizes would be identical and there would be times when not all household fish consumers would consume every fish meal brought into the household. Thus, Ebert et al. (1993) also calculated fish consumption rates assuming that only the adults in the household shared the fish that were brought into the household and, as an absolute upper bound, assuming that only the angler himself ate all of the fish brought into the household.

While this analysis was undertaken to evaluate the sensitivity of the consumption rate distribution to this assumption, it cannot be considered representative of actual consumption behavior. On the contrary, in the Ebert et al. (1993) survey, the anglers who provided the data underlying the estimates clearly indicated, for the most part, that they shared the fish that came into their households with other fish consumers in the household. Survey respondents provided the survey authors with the number of individuals in their households who consumed those fish.

In addition, because of the way in which the survey was designed, the survey respondents’ consumption rates were based not only on the fish that they themselves had caught for consumption but also on the fish that other family members had brought into the household and shared with them, as well as fish that had been given to them by other individuals outside of the household. It is not, therefore, reasonable to assume that no sharing occurs. In fact, when considering the Ebert et al. (1993) data, if it were assumed that no sharing occurs, a substantial portion of the fish consumed by individuals and used to estimate their consumption rates would need to be subtracted from the calculated consumption rates. This is because their consumption rates also included consumption of fish that had been caught by other household members and/or other individuals outside of the household and shared with the survey respondent. Thus, a substantial portion of the total fish consumption rates for many of the survey respondents was the direct result of sharing behavior.

Given these data, it is unreasonable to assume that only one person in the household consumed every fish brought into the house, except in those cases where the individuals

reported that they were the only household members who consumed the fish. As to the latter, a total of 138 (14 percent) of the 1,007 anglers for whom a fish consumption rate could be derived in the Ebert et al. (1993) study reported that only one individual within the household consumed all of the fish brought into the household. However, the fish consumption rates for these individuals (which are necessarily based on an assumption of no sharing) *were already included in the general fish consumption distribution provided by Ebert at al. (1993)*. Thus, use of the general fish consumption rates from that survey will already include the survey respondents who reported no sharing; there is no basis for using the separate set of "no sharing" rates that were provided only as a sensitivity analysis.

The assumption of "no sharing" is also not consistent with EPA guidance on assessing risks due to the consumption of fish and shellfish. According to EPA (1989a) guidance, when consumption estimates are derived based on fish harvest, as was the approach used by Ebert et al. (1993) in the Maine angler survey, the average daily consumption rate should be derived by dividing the edible portion of the fish harvested by a household by the number of people in that household (p. 56). In fact, the EPA (1989a) approach is slightly less conservative than the approach used by Ebert et al. (1993), who recognized that household size might not be indicative of the number of individuals in the household who consumed freshwater fish. (Ebert et al. asked survey respondents to identify all household members and to indicate whether or not each of those individuals actually consumed freshwater fish. Only the number of household consumers was used to apportion the fish consumed and derive the reported fish consumption rates.) This approach is consistent with the approach outlined in EPA (1989a) guidance, but results in slightly higher, and more realistic, estimates of fish consumption. On the other hand, the assumption of "no sharing" used in the HHRA is not consistent with EPA (1989a) guidance.

It should also be noted that the approach to sharing in the HHRA is internally inconsistent. As discussed above, fish consumption rates for adults have been selected based on an assumption that fish are not shared within a household. At the same time, however, the HHRA evaluates fish consumption by small children based on the assumption that sharing <u>does</u> occur within a household (HHRA, Vol. I, p. 5-12). This points to the lack of support for the assumption of no sharing, as children would not have access to those fish if others in the household did not share with them.

Use of "All Waters" Consumption Rates

EPA has applied "all waters" fish consumption rates to many river reaches for which these estimates are not relevant. In the Maine angler survey, individuals were asked to record the fish consumed that they obtained from rivers and streams separately from those obtained from lakes and ponds. Fish obtained from multiple waterbodies of the same types (e.g., rivers/streams) were combined to derive the fish consumption rate distribution for each of those waterbody types. In addition, in order to derive total estimates of fish consumption by Maine anglers, Ebert et al. (1993) combined the fish meals obtained from all waterbody types for individual anglers to derive the "all waters" estimates of consumption. These rates represent total fish consumption over the year and include fish consumption from multiple waterbodies in the state and multiple waterbody types. They are not representative of fish consumption from a single fishery or type of fishery. The vast majority of anglers who participated in the survey fished from multiple waterbodies during the year. Thus, these consumption rates overestimate consumption from a single waterbody like the Housatonic River and certainly overestimate consumption from a single section of the river.

EPA selected the "all waters" consumption rate distribution because it assumed that anglers fish both the flowing reaches of the Housatonic and the impoundment (Woods Pond) in Reaches 5 and 6. Given the level of conservatism that is added when one applies the Ebert et al. (1993) fish consumption distributions based on fishing multiple rivers and streams to a single fishery or reach of the river, it is not appropriate to incorporate additional conservatism by selecting the "all waters" distributions to represent these areas. Clearly, people who fish the upper reaches of the Housatonic River are fishing a river reach that is, for the most part, flowing water. While there are some sections that are slower moving (the backwaters and Woods Pond), they are still reaches of the river. Thus, the river/stream consumption distributions are most relevant for the risk assessment.

Even if EPA is concerned that consumption might be underestimated if the river/stream distribution is used, it is still not appropriate to use the "all waters" distribution. Given that some sections of the river are slow moving and are arguably similar to a lake or pond, EPA could use the lake/pond fish consumption distribution if it believes this is more relevant. The river reaches cannot, however, be both types of fisheries simultaneously. Individuals who responded to the Maine angler survey were asked to name the fisheries that they fished most often. If fishing an

area similar to the fishery provided in the area between the confluence and Woods Pond, respondents would have reported their harvested fish in either the river/stream or the lake/pond category, but not both. Thus, one or the other of the available fish consumption distributions (river/streams or lakes/ponds) is appropriate, but a combination of the two should not be used.

GE recommends that, given the nature of the different areas of the Housatonic River, different consumption rate distributions from the Maine angler survey should be used. For Lakes Lillinonah, Zoar, and Rising Pond, the lake/pond consumption rate distribution is most appropriate because these areas are clearly lakes or ponds and have characteristics more similar to them than to rivers/streams. The Trout Management Area is clearly a flowing water area and thus should be evaluated using the river/stream consumption rate distribution. Reaches 5 and 6 should be evaluated using either the river/stream or the lake/pond consumption rate distribution, depending upon where EPA believes the most fishing pressure is likely to occur. While the small size and flowing water of the upper reaches is more like a stream, the slower movement and mode of fishing (most likely to be from canoe) in Woods Pond and its backwaters is more like a pond fishery. Regardless of the distribution selected, the rates used will be very protective for a single small fishery, given that they are derived from data provided by anglers who fished multiple fisheries during the year.

Assuming that sharing occurs, as is appropriate given the available data, the 95th percentile consumption rate for rivers and streams is 12 g/day. For lake/pond fishing, the 95th percentile value is 16 g/day. (The lake/pond estimates are unpublished but have been previously provided to EPA both in report form and in the electronic analysis files.) GE recommends that these rates be used to evaluate exposures due to the consumption of fish from the river.

Child Consumption Rates

EPA has assumed that 1 to 6 year old children are expected to eat fish at half of the adult consumption rate, and has adjusted the adult fish consumption rates from the Ebert et al. (1993) study by a ratio that was derived from EPA (2002), based on USDA data for uncooked fish, by comparing reported consumption rates for 3 to 5 year old children with those for adults. According to EPA, the ratio of child to adult ingestion rates for freshwater/estuarine finfish and shellfish ranged from 0.41 to 0.49. Considering this, EPA used a factor of 50 percent to adjust

the sport-caught freshwater fish adult consumption rates from the Ebert et al. (1993) study to evaluate children aged 1 to 6 years.

The USDA dietary data do not provide an appropriate basis for deriving this ratio because they have a strong bias toward high-level consumers. This is because only those individuals who reported eating fish in a single 2-day period were included in the data for "consumers." Less frequent consumers were not captured in the sampling methodology. In addition, the USDA data do not differentiate between freshwater and estuarine fish or between shellfish and finfish. Thus, they include consumption of many species of estuarine fish and shellfish (i.e., shrimp, clams, scallops, crab, etc.) that are not relevant to freshwater fish consumers. Data provided by Rupp et al. (1980) indicate that the consumption of shellfish by children is substantially greater than the consumption of freshwater finfish.

Rupp et al. (1980) analyzed the data from the National Purchase Diary (NPD) Study, which used a one-month diary of all foods consumed by U.S. residents. Rupp et al. segregated the fish meals consumed by the types of fish: freshwater finfish, saltwater finfish, and shellfish. These data show that, in the New England Region, only one percent of children aged 1 to 11 years consumed freshwater finfish while 36 percent of children this age consumed shellfish. Based on these data, it is likely that approximately 97 percent of children in the New England region who were included in the USDA survey data consumed no freshwater finfish, so that their entire consumption rates were based on the consumption of shellfish. Even when one considers all states combined, as reported by Rupp et al., only 12 percent consumed freshwater finfish while more than twice that many (26 percent) consumed shellfish. Thus, even for the entire U.S. population of fish consumers aged 1 to 11 years, the combined rate of finfish/shellfish consumption is substantially influenced by the regular consumption of shellfish and overstates the consumption of freshwater finfish.

Based on data provided by Rupp et al. (1980), and adjusting to include only those individuals who consumed freshwater fish, it appears that children aged 1 to 11 years consume freshwater fish at approximately 40 percent of the adult rate. It is likely that even 40 percent overestimates consumption by the 1 to 6 year old child due to differences in body size and the fact that children below the age of 7 will eat smaller portions than children between the ages of 8 and 11 years. More general data provided in the NPD research data base (EPA, 1989b) indicated that total fish consumption by 0 to 9 year old children was approximately 36 percent of mean fish

consumption by individuals aged 20 to 70+, for both the average consumers and the upper 95th percentile. Thus, it appears that the use of ratio of 50 percent overstates consumption by young children.

Regardless of the ratio used to estimate fish consumption rates for children, the ratio needs to be applied to the appropriate fish consumption distribution. Thus, for rivers/streams, the RME fish consumption rate should be about 40 percent of the river/stream fish consumption rate for adults (12 g/day) or 5 g/day. For the areas that are to be evaluated using the lake/pond consumption distribution, the RME consumption rates for 1 to 6 year old children should be 6 g/day (40 percent of 16 g/day).

References

Ebert, E.S., N.W. Harrington, K.J. Boyle, J.W. Knight, and R.E. Keenan. 1993. Estimating consumption of freshwater fish among Maine anglers. *N. Am. J. Fish. Mgt.* 13:737-745.

EPA. 1989a. *Assessing human health risks from chemically contaminated fish and shellfish: A guidance manual.* U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, DC. EPA-503/8-89-002. September.

EPA. 1989b. *Exposure Factors Handbook.* U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Washington, DC. EPA/600/8-89-043. July.

EPA. 2002. *Estimated per capita fish consumption in the United States.* U.S. Environmental Protection Agency, Washington, DC. EPA-821-C-02-003. August.

Rupp, E.M., F.L. Miller, and C.F. Baes. 1980. Some results of recent surveys of fish and shellfish consumption by age and region of U.S. residents. *Health Phys*. 39:165-175.