PENOBSCOT RIVER MERCURY STUDY

Chapter 22

Risk Overview

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This section of the report describes the Penobscot River Mercury Study Panel's thinking about mercury (Hg)-related risks and the need for remediation of the upper Penobscot estuary. Based on work done in the Phase I study and also work in Phase II, the Panel has determined that the system is significantly contaminated with Hg. Hg levels in some biota are high enough to harm the animal and to pose a risk to predators who consume them. For three species – lobster, eels, and black ducks – there is also the potential for human exposures above recommended levels. This provides an impetus for remediation. In addition, studies done of the system hydrodynamics indicate that there is a large pool of mobile sediments in the upper estuary that only slowly leaves the river or is buried in the upper estuary, due to blockage by an incoming salt wedge (Chapter 7). As a result, our best estimates of the half-times for natural recovery of various parts of the upper estuary are long (22-36 years, Chapter 6). Note that these are half-times only.

Our data show that at the time of peak releases from HoltraChem, surface sediment concentrations were of the order of 4900 ng/g dry weight in the entire estuary (Chapter 6). In the forty years since peak releases, surface sediment concentrations in the contaminated parts of the river have fallen to around 885 ng/g. However, based on data from upstream of Veazie Dam, recovery of sediment Hg concentrations just below Veazie Dam, including the East Branch and from other nearby rivers, we estimate that the long term surface sediment concentration (i.e., regional background) is of the order of 55 ng/g (Chapter 1). We have concluded that the Hg contamination of the river will remain at levels higher than regional background for many decades until the river cleans itself, absent some active remediation. Mendall Marsh will likely take longer, given how much reduction is needed. However, we have also concluded that if the sediment concentrations of Hg in the upper estuary (between Veazie Dam and the southern end of Verona Island) were reduced to about 450 ng/g (which would take less time to achieve), the consequent contamination of resident biota would be unlikely to pose serious risks. These factors provide an incentive for active remediation.

The rate of recovery estimated based on sediment core profiles (Figure 1-3b) indicates that not only is the recovery rate highly variable, depending on location, but that Hg in the uppermost sediment levels is still increasing in the southern part of the estuary. This suggests that the potential for significant human exposures via lobster consumption may actually be increasing as mercury concentrations south of Fort Point Cove increase.

Complicating any remediation decisions are the facts that the system is very large, the contamination highly dispersed, and much of the Hg in the system is buried in deeper sediments and not contributing significantly to current levels in biota. The possibility that active remediation by some processes such as dredging would disturb buried material with high Hg concentrations is a concern.

In addition to the physical aspects of the Hg contamination noted above, we have considered the extent of harm that result from the contamination. The potential for human exposure to elevated mercury arises from possible consumption of lobster, eels, and black ducks, as noted above. The lobsters found in the Fort Point Cove area are elevated relative to lobsters from other areas in Maine, and on average contain Hg at

concentrations above the guidance level of 200 parts per billion (ppb). In comparison to lobster, eels have higher concentrations than lobsters, around 500 ppb, well above the 200 ppb concentration than the state considers safe. The Study Panel looked for but did not find evidence that significant amounts of eel are consumed by local residents. But at concentrations above 500 ppb, the eels themselves are at risk from toxic effects. In addition, it is recognized that the eels are commercially harvested and shipped overseas for human consumption. Finally, data were collected on Hg in black ducks, which are hunted in Mendall Marsh. In response to the high observed concentrations, an advisory against consumption of black ducks has been issued by the Maine Department of Inland Fisheries and Wildlife.

While human health *may* not be directly at risk from Penobscot contamination, it is clear that Hg concentrations in sediments and in some biota exceed nationally recognized toxicity thresholds. Based on these high Hg concentrations, Hg toxicity to resident biota (plants and animals) probably has already resulted from this contamination, and is still expected to be occurring. The extent to which populations are still in decline in response to this contamination is uncertain, but the extremely high concentrations in song birds in Mendall Marsh exceed acutely toxic levels in other bird species and the Panel concludes that the regional population of Nelson's Sparrows in particular may be imperiled. Moreover, predators of contaminated invertebrates and small fish and birds are being exposed to sufficiently high Hg levels that may put them at risk. By selectively affecting some species in an ecosystem, it is well-recognized that toxic metals, like Hg in this case, can alter the species composition of biological communities in affected ecosystems, leading to population imbalances. Given that Hg concentrations in the Penobscot system exceed widely-recognized toxicity thresholds, and given the slow rate at which natural attenuation is cleansing the system, the Panel concludes that active remediation steps would be appropriate to reduce the biologically available Hg in some targeted regions within the Penobscot region, most particularly the Mendall Marsh ecosystem.

Given the size of the Penobscot system, it is reasonable to consider whether limited treatment of hotspots makes more sense that the systematic remediation than is recommended in Chapter 21. One type of limited treatment that is often applied to large contaminated systems is specific hotspot removal. The main reason that hotspot removal is not recommended is that the apparent size of the pool of mobile sediments (see Chapter 7) suggests that such an approach would not work.