

## **6.0 CONCLUSIONS**

1. The weight of evidence from the caged mussel pilot study and similar studies conducted all over the world suggest that the use of caged mussels is a useful monitoring tool.
2. There are no perfect monitoring and assessment tools and each has its own advantages and disadvantages.
3. A truly integrated monitoring and assessment program should include the elements represented by fish, caged bivalves, and SPMDs.
4. The caged mussel pilot study was conducted to compare dioxin and furan accumulation between fish, caged mussels, and SPMDs at stations upstream and downstream from a pulp and paper mill. This was not a test of the caged mussel methodology, but rather a very specific application dictated by the ability to collect fish at particular locations. Upstream and downstream stations were 13 and 11 miles, respectively, from the outfall. This did not evaluate one of the major advantages of the transplant methodology, i.e., transplanting bivalves and SPMDs along suspected chemical gradients.
5. Bivalves primarily provide estimates from aqueous, particulate, and dietary exposure pathways and better represent bioaccumulation from all those pathways while SPMDs primarily represent aqueous exposures from the water column and are better suited for comparison with water. As the majority of dioxins, furans, and PCBs available to fish and other aquatic life are bound to particulates and other materials, just measuring the aqueous fraction gives a biased estimate of bioavailability.
6. Although statistically significant differences were not found between upstream and downstream in the dioxin/furan study, the mussels were as or more effective than fish in accumulating bioavailable dioxins and furans as demonstrated by the wider range of congeners accumulated than the fish.

## **7.0 RECOMMENDATIONS**

1. The caged mussel (and SPMD) pilot study should be repeated by transplanting mussels (and SPMDs) along a suspected chemical gradient beginning at a point close to the mill.
2. DEP should establish more specific performance criteria for comparing the utility of caged bivalves, fish, and SPMDs.
3. DEP should explicitly state the reasons for emphasizing certain dioxin and furan congeners in their evaluations and the reasons for including or excluding specific PCB congeners in their chemical analyses.

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