Summary

AFS Policy Statement #8:
Coping with Point Source Discharges
(Abbreviated)

Point source discharges include municipal sewage works, steam electric power plants, chemical industries, pulp and paper processing factories, petroleum products industries, and food processing plants. At certain concentrations, point source discharges can alter biological community and ecosystem diversity, nutrient and energy transfer, productivity, biomass, density, stability, connectivity and species richness and evenness. Some ecosystems may recover very rapidly following disturbance and even be dependent upon a certain frequency of perturbation in order to maintain associated biological communities (e.g., periodic flooding of certain types of wetlands). Other ecosystems may be highly resistant to perturbations but, once altered in either structure or function, may require very large amounts of time, often many human generations, to recover. Even this lengthy recovery or rehabilitation may never result in an ecological condition nearly identical to the original. Ecological recovery is thus a combination of two factors: (1) the ability to resist displacement and (2) the ability to snap back to some approximation of the original condition following displacement.

At certain concentrations, point source discharges may alter the following characteristics of fish, shellfish, and related organisms: life, fecundity, growth, visual acuity, swimming speed, equilibrium, flavor, behavior, feeding rate, response time to stimuli, predation rate, photosynthetic rate, spawning season, migration route, and resistance to parasites. All of these endpoints are at the single species level of biological organization. The advantage of working at this level is that most laboratory toxicity tests are carried out with single species, although this is now changing rapidly. The disadvantage is the difficulty of extrapolating from one level of biological organization (in this case, the single species) to higher levels, such as communities and ecosystems. Persuasive evidence indicates that such extrapolations are not robust. Therefore, it is often more cost effective to study both structure and function at the community and ecosystem levels because the species being investigated may disappear through normal successional processes including seasonal change or, for larger organisms such as fish, may move from the point source discharge (even if the discharge is not deleterious) because the organism is following normal behavior patterns. Of course, the more complex and multivariate the system studied, the more variability is likely to be involved. However, structural and functional attributes may be relatively unaffected by normal successional processes, and greatly affected by toxic stress. Probably any characteristic of living material can be altered by certain concentrations of various chemicals. The key to understanding the response is concentration and bioavailability.

Some of the wastes entering the environment are stored in environmental "sinks," such as sediments in lakes or rivers, which may reduce their availability to many aquatic organisms. It is important to determine when this occurs and if it is likely to be a temporary or permanent reduction in bioavailability.

The AFS policy regarding point source discharges is to:

1. Insist that assessments of alternative industrial sites have follow-up programs that include (a) the establishment of pre-project ecological conditions and determination of their normal variability, (b) a hazard evaluation of anticipated waste discharges, and (c) establishment of a biological monitoring system to ensure that desirable water conditions are maintained in a biologically acceptable way.

2. Insist that establishment of baseline conditions include information on recruitment rates, information on community structural and functional characteristics of important species, estimates of important functions such as

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detritus processing, and measurements of chemical and physical parameters.

3. Insist that hazard evaluations include timely toxicity tests (i.e., in time to influence waste treatment design) conducted using pilot or simulated wastes. The frequency of such tests should be determined by (a) the degree of variability in quality and quantity of the point source discharge, (b) the degree of variability in flow and water quality in the receiving system, and (c) the proximity of the waste concentration, after mixture with the receiving water, to the concentration producing a significant adverse biological response.

4. Insist that biological monitoring systems include feedback mechanisms which provide information directly from the system in which quality is to be maintained.

5. Support programs which provide for the (a) identification of biological parameters most suitable for use in protecting aquatic communities, (b) identification of methods and procedures best suited to make these determinations, and (c) determination of the qualifications of the persons making measurements (i.e., certification).

6. Insist that persons conducting hazard evaluations and biological monitoring of point source pollutants be qualified through appropriate certification requirements.

7. Encourage participation of biologists in the determination of methods most suitable for measurement of biological response to point source pollutants.

8. Encourage establishment of a national pool of baseline information on aquatic ecosystems. This should not be interpreted as a call for more publications, but rather increased availability of information already being gathered by industries, state and federal agencies, etc., and presently being kept primarily as "internal" documents.

9. Help broaden the array of species suitable for laboratory bioassays by helping make possible maintenance and culture of additional species under laboratory conditions. Encourage development of multispecies test systems that simulate important ecological cause-effect pathways. This can be done through laboratory microcosms as well as with field enclosures. Selection of key species involves great risks because what may be a key species to human society in terms of interests may not be a key species in terms of ecosystem structure and function. In short, the movement from single species tests low in environmental realism to multispecies tests high in environmental realism should be encouraged except for the "yardstick" purposes mentioned below in item 10.

10. Establish a stock of "standard" genetically uniform reference fish similar to the "white rats" used for mammalian tests. This need not be a native species, but is necessary to provide a reliable "yardstick," against which other results can be compared.

11. Encourage development of water quality standards for toxic chemicals which reflect the need for maintenance of healthy aquatic ecosystems.