UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF WATER

MEMORANDUM

FROM: Ephraim S. King, Director
Office of Science and Technology

TO: William Spratlin, Director
Water, Wetlands and Pesticides

SUBJECT: **Initial Zones of Dilution** for Bacteria in Rivers and Streams Designated for Primary Contact Recreation

I understand that Region 7 is receiving inquiries regarding the appropriateness of initial zones of dilution (i.e., mixing zones[1]) for bacteria criteria in rivers and streams designated for primary contact recreation. This memorandum provides our perspective on this issue. In brief, the presumption in a river or stream segment designated for primary contact recreation is that primary contact recreation can safely occur throughout the segment, and, therefore that bacteria levels will not exceed criteria throughout the segment. Given this, mixing zones that allow for elevated levels of bacteria in rivers and streams designated for primary contact recreation are inconsistent with the designated use and should not be permitted because these could result in a significant health risk. For example, effluent from a wastewater treatment plant that increases bacteria levels ten-fold may be associated with risk that far exceeds those that have been measured in epidemiological studies and judged to be acceptable for protection of human health.

EPA's long-standing policy to ensure protection of human health has been that initial zones of dilution are not appropriate where they may pose "significant health

[1] A mixing zone is a limited, defined area in a waterbody where an effluent discharge undergoes initial dilution and secondary mixing. States and Tribes have discretionary authority to include policies on mixing zones in their water quality standards. 40 C.F.R. 131.13. Such policies are subject to EPA approval. American Wildlands v. Browner, 260 F.3d 1192, 1195 (10th Cir. 2001). EPA does not have "mixing zone" regulations; instead, EPA's recommendations regarding mixing zones are expressed in technical and policy guidance. E.g., Water Quality Standards Handbook: Second Edition (EPA-833-B-94-005a, August 1994); EPA's Technical Support Document for Water Quality-based Toxics Control, March 1991 (TSD). The basic concept of a mixing zone is that it may be appropriate to allow for ambient concentrations above the criteria in small areas near outfalls under certain circumstances so long as the existing and designated use of the water body as a whole is maintained. EPA's Water Quality Standards Handbook: Second Edition (EPA-833-B-94-005a, August 1994). Page 5-1. Regarding mixing zones for bacteria, an important consideration is that there are not significant health risks associated with establishing a mixing zone, considering likely pathways of exposure. EPA's Water Quality Standards Handbook: Second Edition (EPA-833-B-94-005a, August 1994). Page 5-7 to 5-8.

risks"[2] or where "they may endanger critical areas (e.g., drinking water supplies, **recreational areas** (emphasis added), breeding grounds, areas with sensitive biota)".[3] Such a "significant health risk" could be presented where an initial zone of dilution for bacteria is established in rivers and streams designated for primary contact recreation. This is because recreational uses are typically designated for the whole waterbody or segment and people are assumed to be protected for swimming and other contact recreation activities at an acceptable risk level throughout the waterbody or segment. The underlying principle of these zones is that the designated use will be attained even though there is the potential for organisms to be exposed above the protective criteria level. For aquatic life uses, EPA has been clear in stating that initial zones of dilution should be restricted to avoid exposures leading to an acute endpoint of lethality. With respect to recreation and human health protection, the acute endpoint is gastrointestinal illness. People recreating in or downstream from an initial zone of dilution (where bacteria levels may be elevated above the criteria levels) may be exposed to greater risk of the acute endpoint of gastrointestinal illness than would be allowed by the criteria the State adopted to protect the recreational use of the water.

In large rivers in particular, an assumption of complete, immediate mixing may not be appropriate. EPA has recognized that zones of incomplete lateral mixing may extend for the equivalent of many channel widths downstream before uniformly mixed conditions are attained, if indeed they ever are. This means that there could be areas or plumes of higher bacterial concentrations in the ambient water far from the initial discharge point. Because the fate and transport of bacteria in these areas or plumes can be difficult to reliably predict in a river system (in part because of the day-to-day variability in weather conditions and flow), these areas or plumes of higher bacterial concentrations may migrate into various portions of the water segment, including near shore areas. Because people swimming in such an area may ingest water containing high concentrations of bacteria and potentially pathogens – we cannot envision a circumstance where discharges that elevate bacteria levels beyond criteria can be viewed as protective of the primary recreation use in fresh, flowing waters like rivers and streams.

I hope this clarification is helpful. If you have any questions or need additional information, please do not hesitate to contact me or have your staff call Amy Newman at 202-566-0723.

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[2] EPA's Water Quality Standards Handbook: Second Edition (EPA-833-B-94-005a, August 1994). Page 5-7 to 5-8. EPA's Technical Support Document for Water Quality-based Toxics Control (EPA-505-2-90-001, March 1991). Page 34.

[3] EPA's Technical Support Document for Water Quality-Based Toxics Control (EPA-505-2-90-001, March 1991). Page 70.