

PRELIMINARY INVESTIGATION OF THE EXTENT AND EFFECTS
OF SEDIMENT CONTAMINATION IN WHITE LAKE
NEAR THE WHITEHALL LEATHER TANNERY

BY

Dr. Richard Rediske

R. B. Annis Water Resources Institute
Grand Valley State University
One Campus Drive
Allendale MI 49401

Dr. Gary Fahnenstiel

Great Lakes Environmental Research Laboratory
National Oceanic and Atmospheric Administration
1431 Beach Street
Muskegon MI 49441

Dr. Peter Meier

Department of Environmental and Industrial Health
School of Public Health I
University of Michigan
Ann Arbor MI 48106

Dr. Tom Nalepa

Great Lakes Environmental Research Laboratory
National Oceanic and Atmospheric Administration
2205 Commonwealth Blvd
Ann Arbor MI 48105

Dr. Claire Schelske

Department of Fish and Aquatic Sciences
University of Florida
Gainesville FL 32606

INTERAGENCY AGREEMENT NO. DW13947766-01

U. S. Environmental Protection Agency
National Oceanic and Atmospheric Administration

PROJECT OFFICER:

Dr. Marc Tuchman
U. S. Environmental Protection Agency
Great Lakes National Program Office
77 West Jackson Blvd
Chicago IL 60604-3590

December 1997

ACKNOWLEDGEMENTS

This work was supported by an Interagency Agreement (IAG) #DW13947766-01 between the Environmental Protection Agency Great Lakes National Program Office (GLNPO) and the National Oceanic and Atmospheric Administration (NOAA) Great Lakes Environmental Research Laboratory (GLERL). Other funding was provided by NOAA/GLERL and Grand Valley State University (GVSU) Water Resources Institute (WRI).

Project Team

EPA Project Officer

Dr. Marc Tuchman USEPA GLNPO

Principal Scientists

Dr. Gary Fahnenstiel	GLERL	Project Manager, Limnology
Dr. Richard Rediske	GVSU	Sediment Chemistry
Dr. Peter Meier	University of Michigan	Sediment Toxicology
Dr. Tom Nalepa	GLERL	Benthic Ecology
Dr. Claire Schelske	University of Florida	Radiochemistry

Consultants

Dr. Peter Landrum	GLERL	Toxicology
Dr. John Robbins	GLERL	Radiochemistry

Project technical assistance was provided by the following individuals:

NOAA/GLERL	C. Beckman, S. Beattie, R. Stone, and G. Carter
GVSU/WRI	A. Stiop, F. Winkler, J. Oxford, D. Graeber, T. Hudson, and K. Onwuzulike
University of Michigan	K. Bemish
University of Florida	Dr. Jaye Cable

Ship support was provided by the crews of the following Research Vessels:

R/V <i>Mudpuppy</i> (USEPA)	J. Bonam
R/V <i>Shenehon</i> (NOAA)	R. Burns, R. Precious and J. Workman
R/V <i>Remorse</i> (NOAA)	J. Workman
R/V <i>Cyclops</i> (NOAA)	J. Workman

The Gas Chromatograph/Mass Spectrometer used by GVSU for this project was partially funded by a National Science Foundation Grant (DUE-9650183).

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Executive Summary

By using a combination of chemistry, toxicological evaluation, ecological analysis, and radiodating, this investigation has defined the ecological effects and the nature and extent of sediment contamination in the Tannery Bay area of eastern White Lake. The sediments in Tannery Bay represent a source of chromium transport for most of the eastern basin of White Lake. The recent deposition of chromium contaminated sediments exceeding 500 mg/kg in down gradient locations shows that export processes are responsible for the movement of this material from Tannery Bay. Arsenic and mercury appear to be less mobile and are retained in the sediments of Tannery Bay. Chromium export from Tannery Bay into White Lake proper will continue as long as the contaminated sediments are influenced by hydrodynamic circulation patterns and wave action.

Chromium stratigraphy in the Tannery Bay region indicates that the top 15-20 cm of sediment are less contaminated (2,000-4,000 mg/kg) than sediment located at >30 cm (>5,000 mg/kg). Radionuclide results suggest that this surface sediment layer is well mixed, however, distinct from the deeper more highly contaminated sediments. Presently this sediment layer (15-20 cm) does not physically mix with the deeper, more contaminated sediment. The 0-20 cm layer is followed by a region (30-80 cm) that contains chromium levels in excess of 20,000 mg/kg. Since the direct discharge of tannery effluent to this area ceased in 1976, evidence of the deposition of sediment with less chromium contamination should be apparent. The lack of a decreasing gradient of chromium concentration in the near surface zone sediments (0-20 cm) suggests that the processes of mixing and resuspension continue to be active in Tannery Bay. In addition, chromium transport to the 0-20 cm sediment zone may also be occurring by other mechanisms including surface runoff of contaminated soils and groundwater advection. The lack of a significant ¹³⁷Cs horizon in the sediments indicates that groundwater is discharging in this region; however, the linkage with chromium mobility requires further investigation.

The laboratory toxicity evaluation of the Tannery Bay sediments (Ponar samples) found six of eight locations to be toxic to amphipods and two of eight locations to be toxic to midges. The amphipod toxicity was found to be dependent on the depth of the sediment. Sediments evaluated below 30 cm exhibited extreme toxicity to amphipods while some survival was observed in the region of 0-30 cm. We were unable to identify the chemical/chemicals responsible for the toxicity observed in the sediments. Amphipod populations did not reflect the laboratory sediment toxicity as *Hyaella* sp. was found at the same locations that were toxic to the test organisms. This apparent paradox can be explained by examining the natural habitat of these organisms. The native amphipod populations were primarily associated with macrophytic plants and other submerged materials. They did not appear to be associated with the sediments. Similar abundances of chironomids were found at the interior and exterior stations; however, populations of *Chironomus* sp. were significantly lower in the interior stations. The lower abundances of this genera may reflect a response to toxic chemicals in the sediment since they feed on detrital material. Even though chironomids were found in the Tannery Bay area, a majority of the genera were predators which do not ingest detritus as their primary food source. Finally, mercury bioaccumulation was not observed under laboratory or field conditions.

Chromium concentrations in all locations of Tannery Bay and in five of the six downgradient locations in eastern White Lake exceeded current sediment quality guidelines for probable adverse ecological effects. Most of the Tannery Bay stations exceeded these guidelines by an order of magnitude. Only the background station E-1P had a chromium concentration below the sediment quality guideline that would indicate no adverse effects.