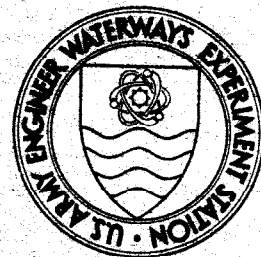


DREDGED MATERIAL RESEARCH PROGRAM



CONTRACT REPORT D-75-4

RESEARCH STUDY FOR THE DEVELOPMENT OF DREDGED MATERIAL DISPOSAL CRITERIA

by

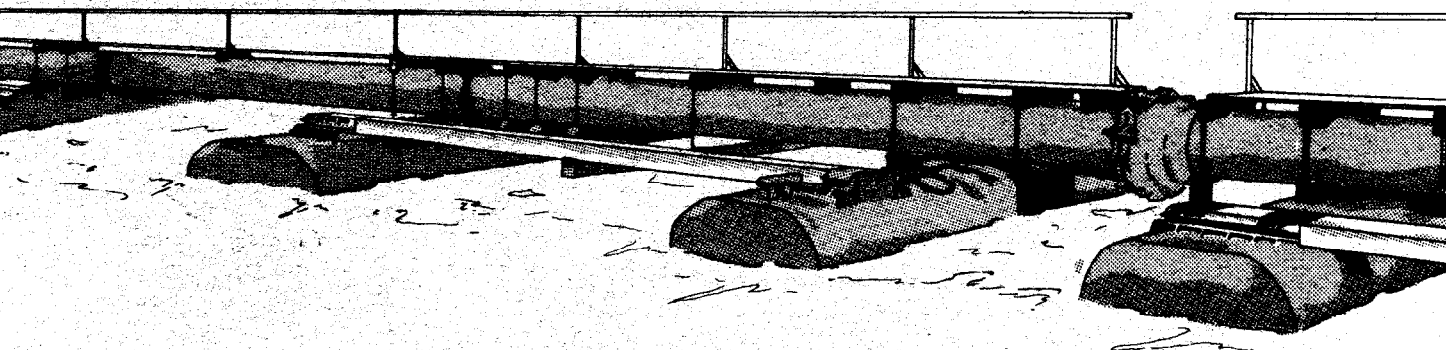
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Final Report

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Prepared for Environmental Effects Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

Under Contract No. DACW-39-74-C-0024
(DMRP Work Unit IE03)

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IN REPLY REFER TO: WESYV

30 November 1975

SUBJECT: Transmittal of Contract Report D-75-4

TO: All Report Recipients

1. The Dredged Material Research Program (DMRP) is a broad multifaceted investigation of the environmental impacts and aspects of dredged material discharge and includes the development of new or improved disposal alternatives. In the early stages of the DMRP's problem definition and assessment and research program development phases, it became apparent that an understanding of the actual pollution potential of dredging and discharging of sediments required substantial state-of-the-art improvement in a number of fundamental aspects. Particularly critical were basic matters of sediment chemistry relating to the locations of pollutants within the fine-grained and organic sediments often involved in dredging projects and, dependent upon these locations, their actual availability to the environment to cause water-quality and/or biological effects.

2. While a several-year-long outline of relevant research was developed and initiated, it became apparent that existing and proposed dredged material discharge regulatory guidelines and criteria did not include sampling and analytical techniques that reflected adequately the existing knowledge as to effective ways of assessing environmental impact potential. Provided an opportunity to help direct the criteria development for recently promulgated regulatory programs (Public Laws 92-500 and 92-532), the DMRP recognized the need to initiate immediately short-term efforts to help refine interim test procedures specified for use in the regulatory programs and to develop new procedures for even more effective impact assessment under all environmental conditions. This work unit is the primary effort in that regard.

3. The contract report transmitted herewith represents the results of the second phase (laboratory evaluation) of a two-phase study to establish the relationships between the presence of various contaminants within sediments and the effects of sediment dredging and discharge on water quality and aquatic organisms. The first phase of this research resulted in a detailed review of literature concerning past and current

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dredged material disposal criteria and discussed their applicability and problems with interpretation. This study is one of several work units included under Task 1E (Pollution Evaluation) of the Corps of Engineers DMRP. In the DMRP's management structure, it is included as part of the Environmental Impacts and Criteria Development Project.

4. The basic analytical procedure specified for use in implementing the requirements of Public Laws 92-500 and 92-532 is referred to as the Standard Elutriate Test. This report discusses the factors influencing the release of chemical contaminants from dredged sediments during the elutriate test procedure and evaluates the effectiveness of the test in comparison with other procedures such as bulk sediment analysis. Individual parameters included and numerical values assigned to them as indicators of levels of pollution are discussed individually.

5. Sediments used for the Standard Elutriate Test evaluation and subsequent bioassay research were from the Trinity River, Houston Ship Channel turning basin, Port Aransas Channel, and Corpus Christi Bay, Texas; Mobile Bay, Alabama; Bridgeport, Connecticut; and Ashtabula, Ohio. The oxygen content of the elutriate was found to be one of the most important factors influencing the release of chemical contaminants from dredged sediments during the test. However, the test was found to be insensitive to many other parameters, such as shaking time, method of agitation, solid-to-liquid ratio, and various filtration procedures. Under oxygenated conditions only manganese (II) and ammonium were released in potentially significant amounts. Little or no release of nitrate, organic nitrogen, total phosphorus, orthophosphate, copper, lead, cadmium, iron, or PCB's occurred. Zinc and selected chlorinated hydrocarbon pesticides such as the DDT group were removed from the test water by some sediments. Bioassay tests using Daphnia magna and Palaemonetes pugio (grass shrimp) exhibited various biological responses to the elutriate. These responses were related to the availability of chemical constituents in the elutriate and in the sediment.

6. The information and data published in this report will be instrumental in further understanding the complex nature of sediment-water, chemical-biological interactions and have set a baseline from which to develop meaningful regulatory criteria. It is expected that the methodology employed in this study and the resultant interpretation of the chemical-biological interaction will be of significant use to those persons concerned with CE dredged material permit programs.



G. H. HILT

Colonel, Corps of Engineers
Director

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Elutriate Test was designed to evaluate the release of chemical contam- inants from hydraulically dredged sediments at the disposal site water column. An evaluation of the factors influencing performance of this test has been conducted. Sediments used were from the Trinity River, Houston Ship Channel Turning Basin, Port Aransas Channel, and Corpus Christi Bay, Texas; Mobile Bay, Alabama; Bridgeport, Connecticut; and Ashtabula, Ohio, Harbor on Lake Erie. The oxygen content of the elutriate was found to be one of the most (Continued)		

20. ABSTRACT (Continued)

important factors influencing the release of chemical contaminants from dredged sediments during the Elutriate Test. Under oxic conditions, only manganese (II) and ammonium were released in potentially significant amounts to the elutriate from the sediments tested. Little or no release of nitrate, organic nitrogen, total phosphorus, orthophosphate, copper, lead, cadmium, iron, or PCB's occurred. Zinc and selected chlorinated hydrocarbon pesticides, such as the DDT group, were removed from the test water for some sediments. The amounts of ammonium and manganese released are potentially sufficient to cause acute lethal toxicity to some forms of aquatic life in the disposal site water column, under conditions of little or no mixing of disposal site water with the water in contact with the dredged sediments. Since normal disposal practices for hydraulically dredged sediments involve dumping of the dredged sediments in open water, no acute lethal or significant chronic sublethal effects would be expected in the water column at the disposal site from the chemical contaminants present in the dredged sediments. Bioassay tests using Daphnia magna for Ashtabula Harbor sediments and Palaemonetes pugio (grass shrimp) for the Corpus Christi Bay sediments showed no toxicity in the elutriates to these organisms in the 96-hour period. Some toxicity was found for P. pugio in the elutriate-sediment mixture from the Bridgeport samples. Because of the importance of dissolved oxygen in influencing the performance of the Elutriate Test, a modified test is recommended which employs compressed air agitation during the 30-minute mixing period. Also it is recommended that the amount of sediment present in the elutriate mixture be reduced from 20 percent to 5 percent. This approach would greatly improve the yield of elutriate for chemical analysis and increase the ease of performance of the test without any detriment to interpretation of the test results.

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