

EXECUTIVE SUMMARY FROM:

DREDGED MATERIAL RESEARCH PROGRAM

TECHNICAL REPORT

SIGNIFICANCE OF PCB'S IN DREDGED SEDIMENTS

by

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EXECUTIVE SUMMARY

Polychlorinated biphenyls (PCB's) are widespread contaminants of U.S. waterway sediments. They are of concern because they can bioaccumulate in fish, shellfish, and other organisms eaten by man, to levels above the Food and Drug Administration limit, thereby representing a potential hazard to man. The almost ubiquitous occurrence of PCB's in waterway sediments has raised questions about the potential significance of dredging and dredged material disposal to further increasing the PCB content of aquatic organisms residing in the regions of dredging and disposal.

As part of the Corps of Engineers Dredged Material Research Program (DMRP), several studies were conducted on the behavior of PCB's in dredged sediments under both laboratory and field conditions. Further, other studies have provided information that is pertinent to assessing the significance of PCB's in waterway sediments that are to be dredged. Based on a review of these studies, it is concluded that at this time there is insufficient information available to establish a critical concentration of PCB's that can be used to determine the potential impact on disposal site water quality-aquatic organisms that may result from dredging, open water disposal operations, or the overflow water from a confined disposal area. While it is not possible to quantitatively predict, based on bulk sediment analysis or elutriate test results the amount of PCB release that will occur as the result of dredging and dredged material disposal, the previous studies have clearly demonstrated a number of important conclusions concerning the significance of PCB's in dredged sediments and have provided guidance on how those responsible for administration of dredging and dredged material disposal programs should proceed to evaluate, on a case-by-case basis, the significance of PCB's in a particular sediment scheduled to be dredged. The key aspects of these studies are discussed below.

Bulk Sediment Criteria

The results of numerous studies conducted during the Dredged Material Research Program have shown that bulk sediment criteria, such as those used by the US EPA Revision V for the Great Lakes' region, are not a technically valid basis by which decisions can be made about the potential significance of sediment-associated PCB's to water quality during dredging and dredged material disposal. Elevated PCB concentrations in sediments do not indicate that there will be release of PCB's during open water disposal or that there will be significant PCB uptake by organisms living in contact with the PCB-containing sediments at the dredging or disposal sites.

Release to the Watercolumn

The elutriate test on eight sediments collected from seven waterways across the U.S. have shown that in general little or no PCB release will occur to the watercolumn during typical dredging and open water dredged material disposal operations. The release that does occur, which seems to be associated with what are considered the "cleanest" sediments, would, under normal open water disposal conditions, be rapidly diluted to sufficiently low levels so as to represent no problems as far as increasing the PCB content of organisms residing in the dredging and open water disposal area watercolumn. There are, however, potential problems associated with so-called confined disposal operations in which there is overflow to the nearby watercourse. If there were substantial release of PCB's which was not taken up by the particulates and if the confinement area were used for extended periods of time, it is possible that organisms residing in the region where the confined disposal area return water enters the waterbody could be exposed to sufficient concentrations to accumulate excessive amounts of PCB's within their tissues. These problems will most likely occur near overflow return areas where there is limited mixing with the open waters of the waterbody, where there is intensive, essentially constant

habitation by organisms that are used by man as food and where suspended solid content of the overflow and ambient water is relatively low. This combination of factors would be expected to rarely occur. Therefore, in general, even if there were release of PCB's from sediments in confined disposal areas, the likelihood of these releases causing PCB's to accumulate within edible aquatic organisms to the point where they would render the organisms unsuitable for human food as defined by the FDA PCB limit, would be remote.

Direct PCB Uptake from Redeposited Dredged Sediments

While few significant watercolumn water quality problems would be expected to be associated with open water disposal of PCB-containing dredged sediments, there may be direct uptake of PCB's from the redeposited sediments in the disposal area.

It is possible that under certain conditions some benthic or epibenthic organisms living on contact with sediments containing PCB's would accumulate significant PCB's through direct sorption or through food web accumulation to cause these organisms to be unsuitable for human food. Studies conducted by the authors in which the flesh of benthic and epibenthic organism (crabs and flounder) collected at and near the New York Bight mud dump site was analyzed for a variety of chlorinated hydrocarbon pesticides and PCB's, showed that PCB levels within the organisms were well below the FDA limit. At this time there is no way to reliably predict, based on sediment analyses, elutriate tests, etc., the potential for significant direct bioconcentration of PCB's by benthic and epibenthic organisms. The approach that should be followed to make this assessment is to collect organisms of concern from a disposal site which has been previously used for disposal of sediments of the type that are proposed to be dredged, and analyze these for their PCB content. The organisms collected must be of the type that are edible by man since at this time there is insufficient information available to enable any valid assessment to be made of the significance of the PCB content of many lower forms of organisms which are not nor-

mally used as human food. If these studies on edible organisms from a dredged material disposal area which has been receiving sediments from a particular region show PCB concentrations above the FDA limit of 2 ppm, then it may be assumed that there is a potential for direct transfer of PCB's from the sediments to the organisms of concern. Special studies would then have to be conducted to evaluate whether or not the "excessive " (based on FDA limit) concentrations of PCB's are derived from the redeposited dredged sediments or from some other source. The sampling program must be carried out seasonally over the annual cycle with particular focus on the times of the year when there is commercial or recreational harvest of organisms that spend at least part of their annual cycle in the region of the dredged material disposal site.

During a particular dredging and disposal operation it is possible that some organisms in the area will accumulate PCB's in excess of the FDA limit. During these times the commercial and sport harvesting of these organisms should be prohibited. It is likely that once the dredging has ceased, the organisms will purge themselves of the PCB's to the extent that their content is below that thought to be detrimental to man when the organisms are used as part of his food.

Comments on US EPA Water Quality Criterion for PCB's

The US EPA's Quality Criteria for Water of July, 1976 (Red Book) has presented a 1 ng/l water quality criterion for PCB's. There are several aspects of this criterion that are pertinent to dredging and dredged material disposal. First, it should be pointed out that while it is indicated by the US EPA that this criterion is applicable to the total PCB content of a water sample, this approach is technically invalid for many waters. Recently the American Fisheries Society has published a critique of the US EPA water quality criteria - Red Book, including the PCB section. It is pointed out that the 1 ng/l criterion was developed for and was probably applicable to the upper Great Lakes.

It is certainly not, however, applicable to many other waters of the U.S. The basis for the PCB criterion of 1 ng/l was the bioconcentration of PCB's in fish. It was originally based on the fact that in the upper Great Lakes region, PCB's in excess of a few ng/l would bioconcentrate in game fish to the point where they would have concentrations of PCB's in their flesh in excess of the FDA PCB safe level for human food. Until recently this safe level has been 5 ppm; it has now been dropped to 2 ppm. The 5 ppm value was arbitrarily established based on what is generally considered to be an inappropriate technical foundation. The 2 ppm level, however, appears to be somewhat better substantiated and is based on a number of animal feeding studies. It is important to emphasize that while many effects of PCB's on aquatic systems are alleged, at this time the only justifiable reason for limiting PCB's is their bioconcentration in food that is used by man.

It should also be noted in viewing the PCB criterion that the upper Great Lakes have somewhat unique properties compared to most other waters of the U.S. in that they are relatively free of particulate matter. Since PCB's tend to strongly sorb on particulates and since most natural waters in the U.S. would have much greater particulate content than the upper Great Lakes, there are serious questions about the general applicability of the 1 ng/l criterion for water, to all waters of the U.S. Studies in various waterways and harbors of the U.S. have shown that there are waters which contain PCB concentrations considerably above the 1 ng/l limit without having bioconcentration of PCB's within fish living within those waters, to values in excess of the FDA 2 ppm limit.

One should not automatically assume because a few ng/l of PCB's are found in a water sample that this represents excessive PCB's in the aquatic system. The only approach that can be taken today to interpret the significance of a particular concentration of PCB's in a water is to use the few ng/l concentration as a indicator of potential problems and then analyze fish from the region to see if they have actually accumulated PCB's above the FDA limit.

The 1 ng/l criterion for water has another special problem that

makes its utility extremely difficult. This is the fact that the best of the analytical procedures that are normally used for PCB's do not measure PCB's at this low level. Therefore, since the focal point of concern about PCB's is their accumulation within fish and other edible aquatic organisms to levels above the FDA limit, then the appropriate approach that should be taken is to analyze these organisms for their PCB content rather than attempting to analyze water, sediments, or some other non-edible organism. The latter types of data are essentially uninterpretable. The data from the edible organisms are directly interpretable in terms of the FDA limit.

Summary

It is concluded that U.S. waterway sediments contain sufficient concentrations of PCB's to be of potential significance to water quality during dredging and dredged material disposal. At this time, however, there is insufficient information available to predict, based on sediment analyses or elutriate test results, whether the PCB's in sediments represent a potential water quality problem at the dredging and dredge material disposal site. Bulk sediment criteria obtained for the total PCB content of sediments do not serve as a valid basis for developing an assessment of the potential environmental hazard of PCB's, their release to the watercolumn during dredging and dredged material disposal, or the direct uptake of PCB's from sediments by benthic and epibenthic organisms. A case-by-case evaluation of the significance of PCB's associated with a particular dredging project must be made in which primary reliance must be given to examining the PCB content of edible fish and shellfish of the region of dredge material disposal that has received similar sediments in the past, in order to ascertain whether these organisms contain excessive amounts of PCB's based on the FDA limit of 2 ppm in the flesh.