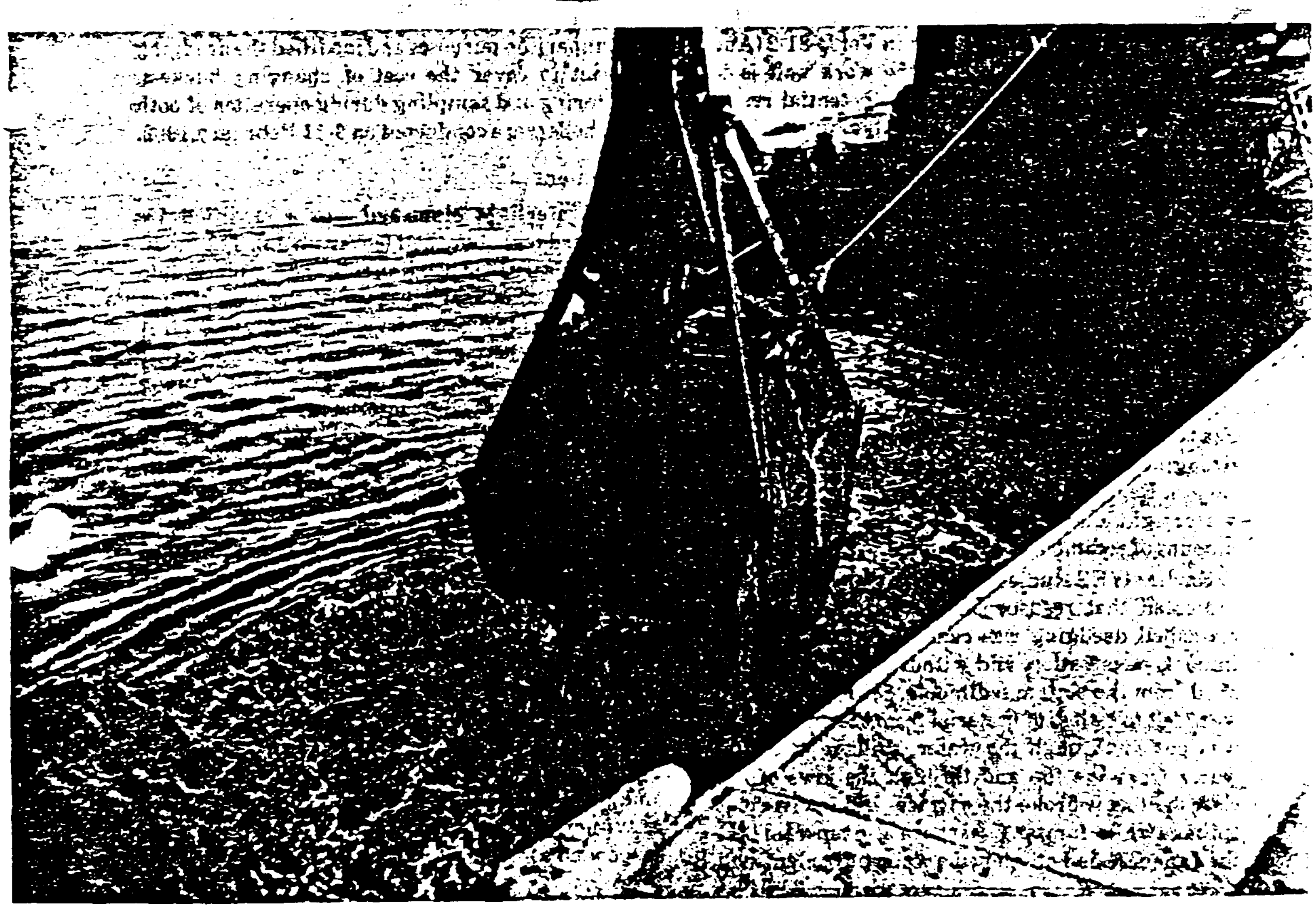
DREDGED MATERIAL RESEARCH

US Army Corps of Engineers

VOL D-83-1
Jan 1983

NOTES • NEWS • REVIEWS etc



WATERTIGHT CLAMSHELL VERSUS STANDARD OPEN CLAMSHELL DREDGING TO REDUCE SEDIMENT RESUSPENSION— A maintenance dredging project in a pier basin at the Jacksonville Naval Air Station, Florida, provided an opportunity to compare the amount of sediment suspended in the water column during dredging operations using the two types of clamshells (the photograph above shows the watertight bucket as it emerged from the water). The study and its preliminary results are described in the following article.

SEDIMENT RESUSPENSION DURING CLAMSHELL DREDGING

*CPT Gene L. Raymond**

The Waterways Experiment Station (WES), in cooperation with the Jacksonville District, conducted a field study to compare the sediment resuspension characteristics of a standard open clamshell and a specially designed watertight clamshell. The literature suggests that use of a watertight clamshell will reduce the turbidity caused by bucket dredging, but does not record any data from projects where both open and watertight clamshells were used under comparable conditions.

This was the first field study conducted under a recently initiated work unit of the Improvement of Operations and Maintenance Techniques (IOMT) Program, which was described in Vol D-81-2 (Aug 81). The overall objective of the work unit is to develop a method for predicting potential resuspension and release of contaminants resulting from various types of dredging equipment and techniques. The field studies are designed to determine the extent and character of bottom sediment resuspended during dredging.

BACKGROUND

The Jacksonville District was the U. S. Navy's contracting agent for maintenance dredging in Pier Basin 139 at the Jacksonville Naval Air Station (Figure 1). In granting a permit for the dredging, the Florida Department of Environmental Regulation (DER) required use of a special watertight clamshell in hope of reducing the amount of sediments resuspended.

Earlier WES studies reported by Barnard (1978) indicated that resuspension of sediments during clamshell dredging was caused primarily by the impact, penetration, and withdrawal of the clamshell from the bottom sediments. Secondary causes were felt to be loss of material from the bucket as it was pulled through the water, spillage of turbid water from the top and through the jaws of the clamshell as it broke the surface, and inadvertent spillage while dumping. Barnard also reported that the Japanese had developed a watertight clamshell that caused 30-70 percent less turbidity in the water column than a similar open clamshell. Barnard attributed this to a 35-percent reduction in loss from the clamshell as it was lifted through the water column and swung over the hopper or scow.

The Jacksonville dredging project offered an opportunity to collect data to determine if dredging with a watertight clamshell did indeed cause less sediment resuspension than use of a standard clamshell. The WES proposed the study and Jacksonville concurred.

The District office obtained permission from DER for the brief use of a standard open clamshell for comparison purposes and modified the dredging contract to cover the cost of changing buckets. Monitoring and sampling during operation of both clamshells were conducted on 9-11 February 1982.

Equipment

The watertight clamshell was a modified 13-cubic-yard (cy) clamshell (cover photo). The modification consisted of welding side and top plates onto the standard clamshell and lining the edge of each half with rubber to achieve a watertight seal. A rectangular opening was left in the top of the box for the pulley and to allow air to escape during submersion. The contractor estimated that the addition of the sides and top probably increased the clamshell's capacity but was unable to verify any increase statistically. The open bucket was a standard 12-cy clamshell (Figure 2).

The excavation was accomplished using standard clamshell dredging procedures. Average hourly production with either bucket was about 770 cy per hour.

Data Collection

During dredging operations, discrete water column samples were taken along three radials at increasing distances from the dredge as shown in Figure 1. Samples were taken at various depths, and suspended solids levels were determined by gravimetric analysis. Samples for background suspended solids levels were also taken each day.

PRELIMINARY RESULTS

The initial analysis of the data was accomplished by comparing suspended sediment levels along

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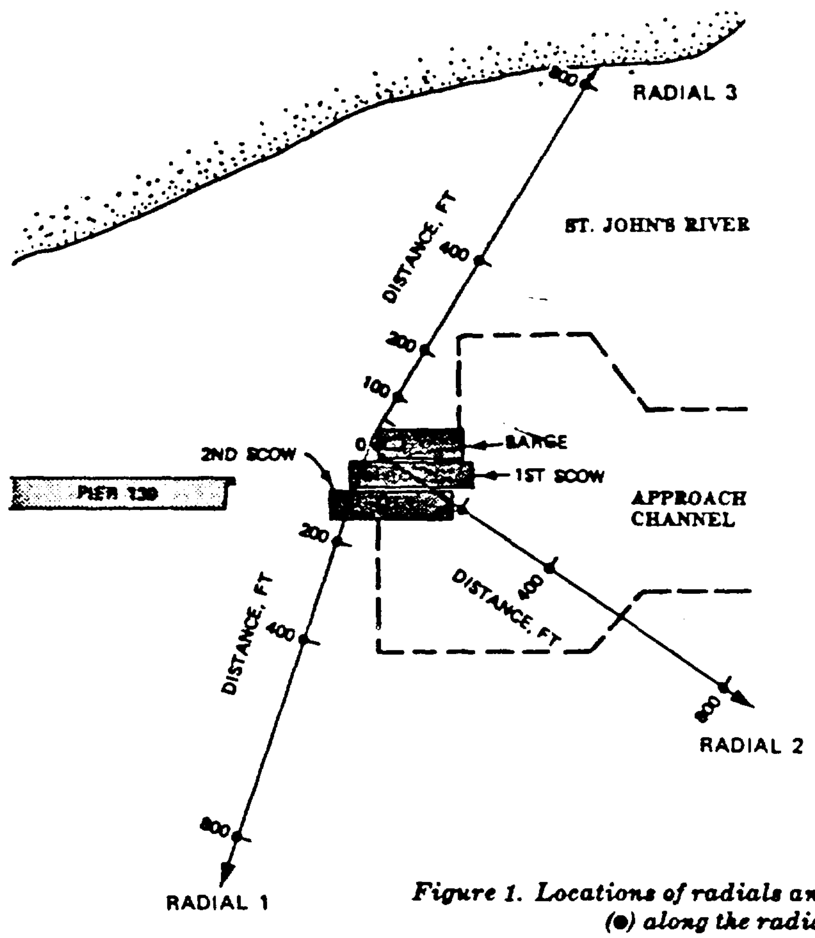

Figure 1. Locations of radials and sampling points (●) along the radials

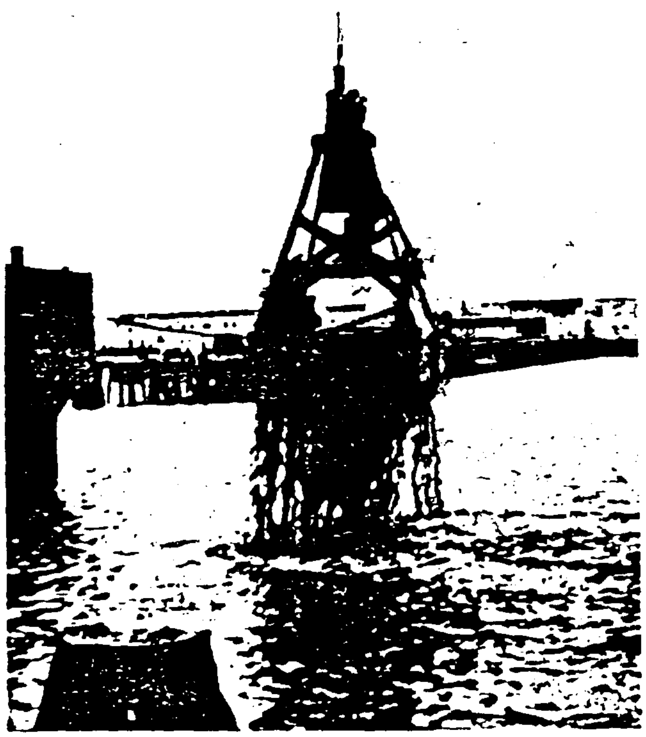

Figure 2. Standard open clamshell bucket emerging from water

each of the three radials. Figure 3 shows the average suspended sediment levels at increasing depths along each radial. Figure 4 shows the amount of suspended sediments found at sampling points along the radials. The values in Figures 3 and 4 were adjusted to compensate for the daily back-

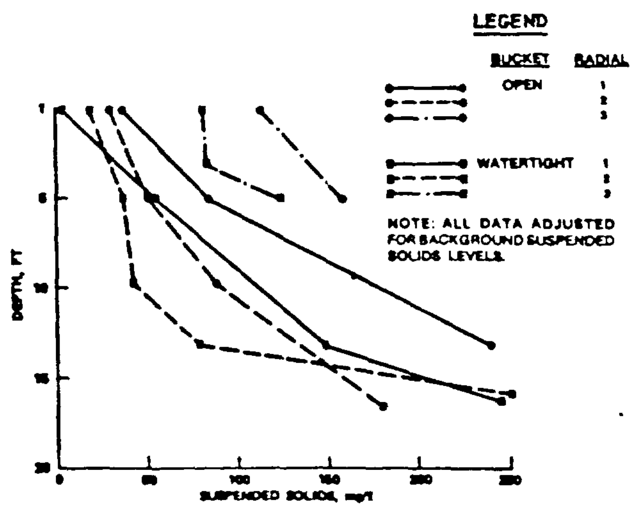

Figure 3. Average suspended sediment levels along sampling radials during clamshell dredging

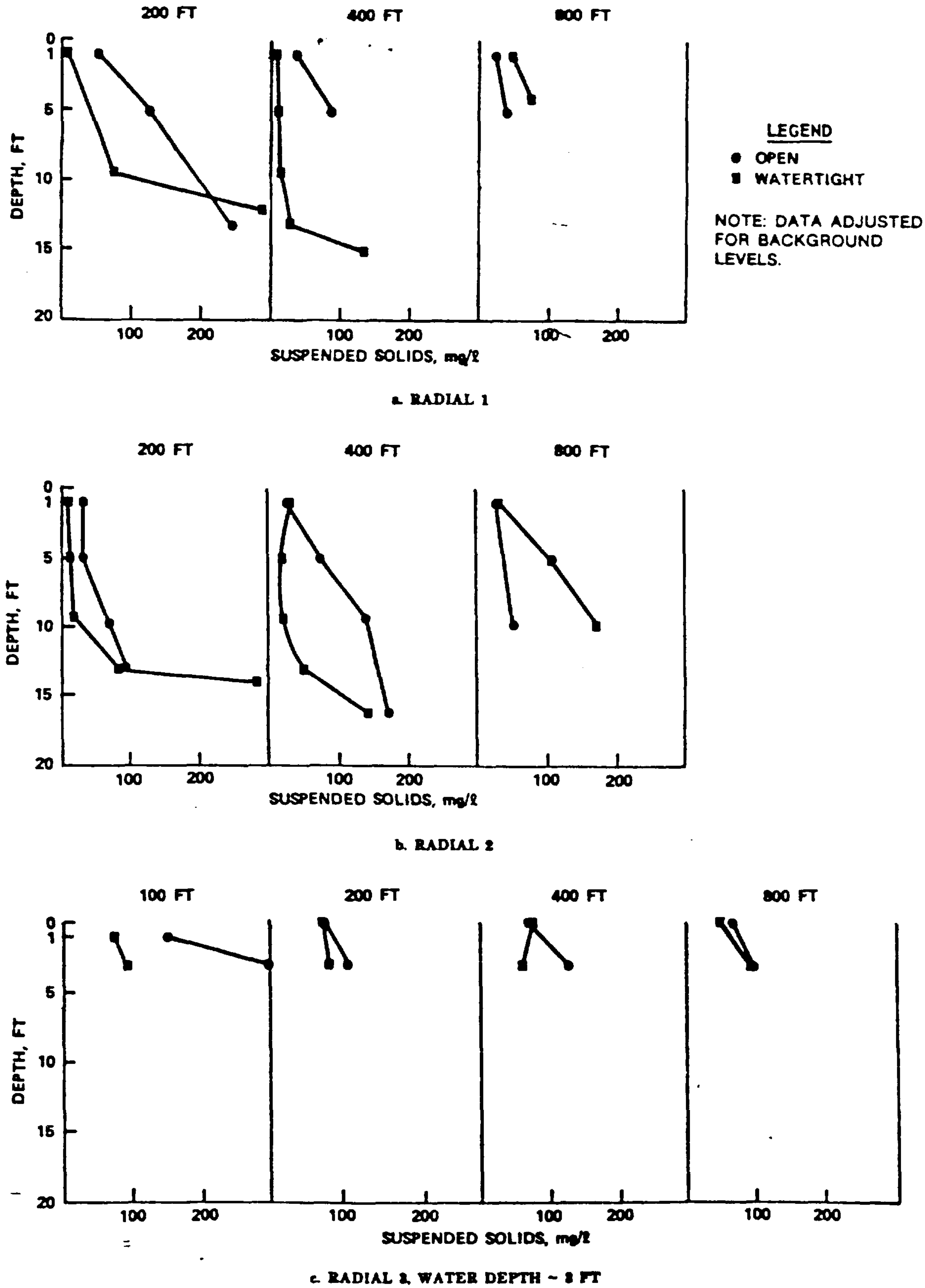

Figure 4. Comparisons of suspended solids levels measured in the water column during dredging with watertight and open clamshells

ground levels for the appropriate depth. Along radials 1 and 2, there appeared to be a marked increase in sediment resuspension nearer the bottom.

Table 1 presents the average values of suspended sediments measured in the upper water column and near the bottom along each radial for each type clamshell. These readings were also adjusted for background levels.

Table 1
SUSPENDED SEDIMENT LEVELS IN THE UPPER WATER COLUMN AND NEAR THE BOTTOM

		*Type Clamshell-Suspended Sediment, mg/l**	
Radial	*Sampling Location*	*Watertight*	*Open*
1	Upper water column	27	123.25
2		35.6	61.0
3		80.6	133.3
1	Near bottom (within 5 ft)	233	146.6
2		300	122.0
3		N/A**	N/A**

* Adjusted for background levels.
** Water depth along radial 3 was about 3 ft.

The data in Table 1 indicate that operation of the watertight clamshell in the upper water column offers a marked advantage over the open clamshell. These data support Barnard's (1978) contention that the advantage of a watertight clamshell is the reduction in losses as the loaded clamshell moves through the water. Table 1 also tends to confirm that the major cause of turbidity in the lower 5 ft of the water column is the penetration, digging, and withdrawal of the clamshell.

ADDITIONAL STUDIES

The Jacksonville study was the first of several IOMT field studies. Two field studies were later conducted to compare the operation of a conventional cutterhead dredge to that of a modified dustpan head dredge in kepone-polluted areas of the James River. The James River studies will be described in a forthcoming WES technical report. Additional clamshell studies will be conducted in FY 83 to build on the insights gained in Jacksonville. These studies will provide information on which to base an assessment of the relative performance of clamshell dredges and dredging techniques with regard to their sediment resuspension characteristics. Similar field studies will be performed for hydraulic cutterhead and hydraulic suction dredges during FY 83.

WES is interested in obtaining unpublished sediment resuspension data or in performing cooperative sediment resuspension studies with any agency using conventional or new dredging equipment and techniques. Contacts at WES are CPT Raymond or Mr. Michael R. Palermo, WESEE, U. S. Army Engineer Waterways Experiment Station, P. O. Box 631, Vicksburg, Mississippi 39180; (601) 634-3932/3753 (FTS) 542-3932/3753.

REFERENCES

Barnard, William D. 1978. "Prediction and Control of Dredged Material Dispersion Around Dredging and Open-Water Pipeline Disposal Operations," Technical Report DS-78-13, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Mississippi 39180.

EEDP = DOTS + LEDO + FVP + . . .

Another acronym has been established within the Corps - EEDP.

Since 1978 the Dredging Operations Technical Support (DOTS) Program has existed both as an OCE-approved program that, among other missions, provided direct technical assistance to the field and as an organizational element in the Environmental Laboratory (EL) of WES. The mission of the DOTS office has expanded to include management or coordination of all dredging-related studies within EL. Included are management of the DOTS technical assistance and monitoring functions, the Long-Term Effects of Dredging Operations (LEDO) Program, the Field Verification Program (FVP), and a work unit on Dredging Contaminated Sediments.

To avoid confusion, the name of the organizational element within EL has been changed from DOTS to the Environmental Effects of Dredging Programs or EEDP. Other than the name change, there will be no changes in operation or services offered by the office. Technical assistance on environmental problems associated with dredging and dredged material disposal continues to be available through the DOTS Program. Mr. Charles C. Calhoun, Jr., is the Program Manager and is assisted by Messrs. Thomas R. Patin and Robert L. Lazor.

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IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

UNITED STATES OF AMERICA, Plaintiff, v. OUTBOARD MARINE CORPORATION, Defendant, Third-Party Plaintiff, and Cross-Claim Defendant, and MONSANTO COMPANY, Third-Party Defendant and Cross-Claim Plaintiff.	)	Civil Action No. 78 C 1004 Honorable Susan Getzendanner

NOTICE OF FILING

TO: All counsel on attached
Service List

PLEASE TAKE NOTICE that we have this date filed THIRD-PARTY DEFENDANT MONSANTO COMPANY'S FOURTH SET OF REQUESTS FOR ADMISSION TO PLAINTIFF UNITED STATES, a true copy of which is attached hereto and served upon you.

This 6th day of January, 1983.

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IN THE UNITED STATES DISTRICT COURT
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UNITED STATES OF AMERICA, Plaintiff, v. OUTBOARD MARINE CORPORATION, Defendant, Third-Party Plaintiff, and Cross-Claim Defendant, and MONSANTO COMPANY, Third-Party Defendant and Cross-Claim Plaintiff.	)	Civil Action No. 78 C 1004 Honorable Susan Getzendanner

THIRD PARTY DEFENDANT MONSANTO COMPANY'S FOURTH SET OF REQUESTS FOR ADMISSION TO PLAINTIFF UNITED STATES

In accordance with Rule 36 of the Federal Rules of Civil Procedure, Monsanto Company requests that plaintiff United States make the following admissions:

REQUESTS TO ADMIT

1. Dr. David Weininger is employed by USEPA.

2. At the request of USEPA, Dr. Weininger reviewed the Thomann Report for scientific validity and commented about it.

3. Dr. Weininger reviewed the Thomann Report and made comments about it in his capacity as an EPA employee.