DRAFT ANALYTICAL REPORT
NEW ORLEANS AREA WATER SUPPLY STUDY

PREPARED AND SUBMITTED BY
LOWER MISSISSIPPI RIVER FACILITY
SLIDELL, LOUISIANA
SURVEILLANCE AND ANALYSIS DIVISION
REGION VI
U. S. ENVIRONMENTAL PROTECTION AGENCY

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Prepared and Submitted by

Lower Mississippi River Facility
Slidell, Louisiana
Surveillance and Analysis Division
Region VI
U.S. Environmental Protection Agency
Dallas, Texas

with Technical Assistance as Noted

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ACKNOWLEDGEMENT OF TECHNICAL ASSISTANCE

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Analytical Chemistry Branch
Southeast Environmental Research Laboratory
NERC-Corvallis
U. S. Environmental Protection Agency
Athens, Georgia

Water Supply Research Laboratory
NERC-Cincinnati
U. S. Environmental Protection Agency
Cincinnati, Ohio

Robert S. Kerr Environmental Research Laboratory
NERC-Corvallis
U. S. Environmental Protection Agency
Ada, Oklahoma

Houston Facility
Region VI Surveillance and Analysis Division
U. S. Environmental Protection Agency
Houston, Texas

We also wish to acknowledge the participation of the following individuals or groups outside the Agency.

Mr. Gregor Junk
USAEC - Ames
Ames, Iowa

Gulf South Research Institute
New Orleans, Louisiana

The staff of the Lower Mississippi River Facility particularly wish to express their grateful appreciation for the assistance extended in the sampling operation by all plant personnel at the Carrollton Water Plant (City of New Orleans), the Jefferson Parish No. 1 Water Plant (Metairie) and the Jefferson Parish No. 2 Water Plant (Marerro).

INTRODUCTION

In July 1974, representatives of the State of Louisiana and the City of New Orleans tendered a request to the Region VI Administrator, United States Environmental Protection Agency (EPA), that the agency undertake a sampling and analytical survey designed to determine, to the extent possible, the identities and quantitative concentrations of trace organic compounds which might be present in the finished water of the Carrollton Water Plant (City of New Orleans), Jefferson Parish No. 1 Water Plant (Metairie), and the Jefferson Parish No. 2 Water Plant (Marerro). The request was accepted and agreed to by the EPA Region VI Administrator. Immediately thereafter, a plan and schedule were formulated for conducting the necessary sampling and an assignment was made of an analytical coordinator to make arrangements for the required analytical assistance. The assignment for sampling and analytical coordination was given to the Lower Mississippi River Facility, Slidell, Louisiana, a field facility of the Region VI Surveillance and Analysis Division. This facility was instructed to have sampling operations completed by mid-August 1974, and an analytical report issued by the end of October 1974. The present report is the Draft Analytical Report for this project. It cannot be considered a final report as some phases of the analytical work are incomplete. However, sufficient information is on record to warrant issuing this report as scheduled. This analytical study did not encompass an evaluation of the public health significance of the results presented herein.

A very comprehensive sampling and analytical program was developed and placed in operation, as is illustrated in Table I and described in some detail in the Summary of Experimental Methods. It may be necessary, however, to explain one thing here. The carbon adsorption methods sampling program was established on the assumption that a person would normally consume one liter of water (approximately one quart) per day. Thus the use in Table 1 of the terms 70 year equivalent, 10 year equivalent, 1 year equivalent, etc. has reference to the volume of water sampled equivalent to the amount a person might consume in that period of time at the one liter per day rate. The other sampling methods were added to the project to provide a means of detecting compounds of a type undeterminable by the carbon adsorption-chloroform extraction methods or to provide some comparative evaluation of sampling methods in an as yet experimental stage of development.

To perform the necessary analytical work for this project, the analytical coordinator through the Regional Administrator requested and was granted the technical assistance of several groups within the Environmental Protection Agency's research centers having highly developed and competent analytical expertise and the necessary instrumentation to perform the required analytical operations. While their assistance has been acknowledged in a previous section, it should be stated here that the actual analytical results presented herein represent the efforts predominantly of the Analytical Chemistry Branch, Southeast Environmental Research Laboratory (EPA), Athens, Georgia, and the Water Supply Research Laboratory, NERC-Cincinnati (EPA), Cincinnati, Ohio.

SUMMARY OF EXPERIMENTAL METHODS

Shown in Table I is a distribution of work operations for the New Orleans water supply study as developed. This table provides in short form information on the sampling methods employed, the specific water plants sampled, inclusive dates sampling was performed, the group performing the sampling operation, water volume sampled, group preparing the sample for analysis, and finally the group performing the analysis. Below is a brief description of the various sampling, sample preparation, and analytical methods used.

Sampling Methods

Carbon Adsorption. Three types of carbon adsorption units were employed. The Mega sampler is a relatively large scale trailer mounted unit obtained for the purpose of this project from NERC-Cincinnati. It consists of four cylindrical columns which can be packed with activated carbon (approximately 22 pounds of carbon per unit) and connected in series. In this study only two of these columns in series were used. The Mega sampler, was employed only at the Carrollton water plant.

The CAM sampler is a Pyrex cylinder "3" diameter by 18" length of sufficient capacity to contain approximately 12 ounces of granular activated carbon. These units are outfitted with various fluid flow control and measuring devices. In collecting the 70-year equivalent samples, two packed columns connected in series were employed at each

plant. In collecting the ten-year and one-year equivalent samples, only one unit per sample was employed.

The Mini-sampler is a miniaturized version of the CAM sampler. The sample column is of Poly Vinyl Chloride (PVC) construction and of sufficient capacity to contain 70 grams of 14 x 40 mesh activated carbon. Like the CAM sampler, this unit is outfitted with fluid flow measuring and control devices. The two-month equivalent samples and one-day equivalent samples were obtained with one unit per sample at each water plant.

In all carbon adsorpotion samplings, EPA personnel were assisted by water plant personnel.

Precise details on the carbon adsorption sampling procedures may be obtained by contacting

Mr. Ernest Douglas
U. S. Environmental Protection Agency
Lower Mississippi River Facility
P. O. Drawer N
Slidell, Louisiana 70458

XAD Resin Adsorption. This method developed by Mr. Gregor Junk, USAEC-Ames, uses a macro-reticular synthetic resin (Rohm and Haas XAD-2) contained in a miniature scale column. Its connections allow it to be quickly connected to a small diameter water line. The unit consists solely of the sample column not equipped with fluid flow control or measuring devices. The sampling operations were performed by Mr. Junk assisted by EPA-LMF personnel. Precise details on the XAD resin adsorption method may be obtained from:

Mr. Gregor Junk
USAEC-Ames
Ames, Iowa

Liquid-Liquid Contact Extraction. This sampling method was adopted by general agreement among the analysts with the intention that it would facilitate the recovery and analysis of highly volatile organics which it was feared might be lost in the sample processing procedures associated with the adsorption techniques. At each plant triplicate one liter samples of finished water were extracted in separatory funnels with 2 ml of tetralin (a high boiling tetrahydronaphthalene). The immiscible liquid phases were allowed to separate, the water drained and discarded, and the tetralin recovered into septum vials (Teflon-lined septums), sealed and delivered to Southeast Environmental Laboratory for analysis. Precise details concerning the Liquid-Liquid extraction sampling method may be obtained from:

Mr. John Pope
Analytical Chemistry Branch
Southeast Environmental Research Laboratory
U. S. Environmental Protection Agency
Athens, Georgia

Reverse Osmosis. This semi-permeable membrane water purification method is as yet in an experimental stage of development for use as a solute concentration method to facilitate trace organics analysis. Its use for this purpose is undergoing evaluation at the EPA Water Supply Research Laboratory, NERC-Cincinnati, which requested its inclusion in the project with sampling performed by Gulf South Research Institute. No analytical data from this technique have been derived for inclusion in this report; consequently it will not be considered further at this time. Details concerning this sampling method may be obtained from:

Dr. Frederich Kopfler
Water Supply Research Laboratory
NERC-Cincinnati
U. S. Environmental Protection Agency
Cincinnati, Ohio

Volatile Stripping (Volatile Organics Analysis, VOA; Bellar Technique). This relatively direct sampling and analytical technique employs helium gas stripping of volatile organics from a small water sample with entrapment of organics on a Tenax or Chromosorb 101 column. This column is then attached to the injection port of a gas chromatograph, and at elevated temperature with carrier gas flow the components are desorbed directly into the analytical instrument.

Under the direction of the Water Supply Research Laboratory, Cincinnati, samples for this technique were collected from a tap in the Carrollton water plant on September 23, 1974, by personnel of the Gulf South Research Institute. Several 50 ml serum vials specially prepared to eliminate any possible organic contamination were provided by WSRL. Samples collected in a carefully prescribed manner were pre-chilled in crushed ice and shipped by air freight in a styrofoam container to WSRL in Cincinnati for analysis. Details of this procedure may be obtained from:

Dr. Robert Melton
Water Supply Research Laboratory
NERC-Cincinnati
U. S. Environmental Protection Agency
Cincinnati, Ohio

Sample Preparation Methods

This description of sample preparation methods is devoted primarily to the process operations which followed the Porous Solid Media Adsorption methods of sample collection.

Mega Carbon Processing. Immediately following its use in sample collection at the Carrollton Water Plant, the Mega sampler was transported to the EPA-LMF laboratories where the activated carbon was removed, distributed in trays in a forced draft convection oven equipped with an activated carbon intake air filter to prevent laboratory air contamination and dried for 10 days at 40°C. At the end of that time the carbon was sealed in new, precleaned, five-gallon metal cans and taken to the Robert A. Taft Center in Cincinnati for solvent extraction. Using the large scale permanently installed extraction unit specifically fabricated for Mega-sampler carbon reflux extraction, the carbon was extracted for 40 hours with 50 gallons of Analytical Reagent grade redistilled chloroform. Following the 40 hour reflux extraction, the extract was concentrated by conversion of the unit to a distillation mode and distillation of excess solvent until a volume of approximately 1/2 gallon remained in the kettle. The concentrated chloroform extract was then recovered and transported in sealed Teflon bottles to the Southeast Environmental Research Laboratory for analysis. Precise details on the Mega carbon sample processing may be obtained from:

Dr. William D. Langley or
Mr. Luther Hunt
U. S. Environmental Protection Agency
P. O. Drawer N
Slidell, Louisiana 70458

CAM Carbon Processing. On removal from the sampling sites, the CAM carbon cylinders were drained of excess water, sealed, and shipped by commercial air carrier to Oklahoma City where they were claimed by personnel of the Robert S. Kerr Environmental Research Center, Ada, Oklahoma, and transported to the Center by private aircraft. The columns were stored at 4°C until carbon processing could be initiated.

Columns were opened in a special carbon handling room designed to minimize the potential for contamination. The carbon was transferred to Pyrex glass dishes and dried at 35-38°C. for 48 hours under a gentle flow of clean air in a mechanical convection oven. The oven air inlet was equipped with a carbon filter to prevent atmospheric contamination.

The dried carbon was transferred to 2200 ml Soxhlet extrators and extracted for 48 hours with chloroform. The chloroform extracts were filtered through solvent-extracted glass fiber filters to remove carbon fines and then vacuum concentrated at temperatures not exceeding 27°C. in rotary evaporators to final volumes of 30-60 ml. The concentrated extracts were transferred quantitatively to 10 ml ampules, several ampules being required to accommodate each extract. The ampules were purged with dry, clean nitrogen and sealed while the contents were held at -50°C. in a cold bath. The filled ampules were maintained under refrigeration (4°C) until shipment to the Southeast Environmental Research Laboratory by air mail. Further details on CAM carbon processing can be provided by:

Dr. William Dunlap
Robert S. Kerr Environmental Research Laboratory
U. S. Environmental Protection Agency
Ada, Oklahoma

Mini-sampler Carbon Processing. The exposed Mini-sampler units, drained and sealed, were forwarded by air express to the EPA Region VI Houston Laboratory facility (HNF). The carbon was removed and oven-dried at 39.5°C for a period of 48 hours. The dried carbon was transferred to Soxhlet extractors equipped with fritted glass disc thimbles and extracted for a period of 48 hours with spectrophotometric quality chloroform.

Each of the two-month equivalent sampler extracts were split in a 1:1 proportion with one portion being evaporated to dryness at 70°C for carbon chloroform extract residue determination and the other portion reduced in volume in Kuderna-Danish evaporative concentrators, quantitatively transferred to 25 ml volumetric flasks and made up to volume with chloroform. The one-day equivalent sample extracts were not split for residue determination but the concentrative evaporation procedures were followed.

The 25 ml extracts were later transferred into vials, sealed, and shipped to Southeast Environmental Research Laboratory for analysis. Further details on the sample preparation methods employed with the mini-sampler may be obtained from:

Mr. Medardo Garza
U. S. Environmental Protection Agency
Houston Laboratory Facility
Houston, Texas

XAD Resin Samples

The XAD resin units were hand carried or sent by air carrier to Mr. Gregor Junk at Ames, Iowa. The samples were extracted with redistilled ethyl ether according to Mr. Junk's established technique on

arrival at Ames. The ether was dried and concentrated to 1 ml in a micro Kuderna-Danish evaporator for GC and GC-MS analysis at Ames. One fourth of each extract was carried to Southeast Environmental Research Laboratory for analysis. All extracts were refrigerated until time for analysis.

Further details on XAD resin processing may be obtained from:

Mr. Gregor Junk
USAEC-Ames
Ames, Iowa

Analytical Methods

Southeast Environmental Research Laboratory

GC and GC-MS (Gas Chromatograph-Mass Spectrometry)

Gas chromatography was performed using a Varian 1400 GC with a flame ionization detector. Typical GC conditions were:

Column:	10' x 1/8" i.d. glass
Packing:	3% SP-2100 on 80-100 mesh Supelcoport
Program:	6 min. initial hold; then from 40°--280° at 6°/min.
Carrier gas:	helium at 20 ml/min.
Sample size:	2 ul

For the tetralin extracts, the temperature program was usually a 1 min. hold at 35° (with the oven door open) followed by an increase to 210° at 10°/min.

GC-MS instrumentation was a Finnigan 1015 system interfaced via a Gholke separator to a modified Varian 1400 GC. This system was interfaced to a Systems Industries System 150 computer for data acquisition, data storage, and data reduction and manipulation.

Some initial GC-MS work was done on a Varian MAT CH5/DF system interfaced to a Varian 2740 GC via a Watson-Biemann separator and to a Varian SS-100 Data System. This instrument was later used for confirmation of the presence of Atrazine in the Carrollton 70-year CCE by accurate mass measurement at a resolution of about 5000 amu.

Gas chromatography on these GC-MS systems was performed using a similar column and conditions to those employed in the GC runs described above. Mass spectrometer electron voltage was 70.

Mass spectra stored on disks from the Finnigan CG-MS runs were compared via acoustacoupler connection with spectra in the EPA-Battelle computer files at Battelle (Columbus).

Quantitative Analysis

The Perkin-Elmer PEP-1 Data System, interfaced to a Varian 1400 GC containing a SP-2100 column and operated under the conditions described above, was used for computerized quantitation and retention time measurements. Since Atrazine was present in all extracts of New Orleans samples, it was chosen as an internal standard. A stock solution of 5 parts-per-thousand of Atrazine (99.7% pure) in chloroform was the reference for quantity of all identified compounds for which standards were obtained. Standards, obtained from the laboratory supply or from commercial sources, if time permitted, were mixed in known concentrations with other standards and with a known amount of the Atrazine reference stock solution. Mixtures were designed so as to obtain good GC peak resolution. The Atrazine was assigned a flame response of 1.000 and, since its concentration was known, the computer system was able to calculate the flame response, as well as the relative retention time, of each standard.

After tentative identification of compounds by GC-MS, a PEP-1 computer program was written for the GC-computer run of each extract, allowing the computer to use the known flame responses to calculate concentrations. In some cases, the flame response calculated for a standard was also used for other compounds of the same chemical class. The relative retention times, calculated for all compounds and printed out by the computer, were then manually compared with those of the available standards. It was necessary to dose the blanks with Atrazine as an internal standard, since it was ascertained that Atrazine was not present in them.

If time permitted, mass spectra of the standards were obtained on the Finnigan GC-MS system for visual comparison with those of the compounds.

Further details on the analytical methods employed at SERL may be obtained from:

Dr. A. W. Garrison, or
Dr. Larry Keith
Analytical Chemistry Branch
Southeast Environmental Research Laboratory
U. S. Environmental Protection Agency
Athens, Georgia

Water Supply Research Laboratory

Volatile Organics Analysis

The following instruments were used:

Perkin-Elmer Model 900 GC

Finnigan 1015D - System Industries 150 GC/MS

The volatile organics were purged from aliquots of the water and adsorbed on a small column containing either Tenax or Chromosorb 103 as described by Bellar and Lichtenberg. Qualitative analysis was accomplished by GC/MS using a Chromosorb 101 column and operating the mass spectrometer in the electron impact ionization mode.

Quantitative analysis of the major components of the volatile organics was accomplished by gas chromatography using the Perkin-Elmer gas chromatograph filtered with 6 foot column of chromosorb 101 and flame ionization detectors.

Standards of chloroform and dichloroethane were prepared by introducing 5 µl and 2.5 µl respectively into one liter of distilled water with a 5 µl syringe. This was thoroughly shaken until dissolution was complete. This stock solution was then diluted 100 fold resulting in concentrations (calculated from literature values of the densities) of 78 ug/l chloroform and 31 ug/l of dichloroethane.

The GC/MS was calibrated according to EPA (J. W. Eichelberger, L. E. Harris, and W. L. Budde, Anal. Chem., 45, 227 (1974) standard procedures.

Further details on the analytical procedures employed at the Water Supply Research Laboratory may be obtained from:

Dr. Robert Melton, or
Dr. Fredrich Kopfler
Water Supply Research Laboratory
NERC - Cincinnati
U. S. Environmental Protection Agency
Cincinnati, Ohio

Processing of Blanks

The foregoing discussion of sampling, preparation, and analytical methods has been concerned with the processing of actual samples. However, to assure that components identified were actually derived from the original samples and were not artifacts, contaminants, or inherent components deriving from the sampling method itself, the sampling media, commercial solvents, or the sample preparations, it was necessary to process blank samples taken through all stages of the operations in parallel with the actual samples. The one exception to this was that no sample blank was developed for the reverse osmosis sampling operation.

As a consequence of this processing of blanks through the analytical stage no components could be accepted as deriving from the finished water samples unless these components were not present at a significant level in the blanks relative to the samples or unless they were identified independently in one or more of the other methods. The details of blank preparation, processing and analysis may be obtained from the individuals previously referred to in discussion of the various methods.

TABLE I

DISTRIBUTION OF WORK OPERATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

Sampling Method	Method Modification	Plants Sampled	Dates Sampled	Sampled By	Water Volume	Sample Prepared By	Analysis By
Carbon Adsorption with Chloroform Extraction	Mega Sampler	Carrollton	7/17-24/74	LMF	300,000 Gals.	LMF	SERL
	CAM 70 yr. equiv.	Carrollton	7/18-24/74	LMF	6,750 Gals.	RSKERL	SERL
		Jefferson No. 1	7/24-8/2/74	LMF	6,759 Gals.	RSKERL	SERL
		Jefferson No. 2	7/24-8/2/74	LMF	6,707 Gals.	RSKERL	SERL
	CAM 10 yr. equiv.	Carrollton	8/6-7/74	LMF	963 Gals.	RSKERL	stored in sealed vials at RSKERL
		Jefferson No. 1	8/6-7/74	LMF	965 Gals.	RSKERL	
		Jefferson No. 2	8/6-8/74	LMF	1,300 Gals.	RSKERL	
	CAM 1 yr. equiv.	Carrollton	8/13/74	LMF	74 Gals.	RSKERL	stored in sealed vials at RSKERL
		Jefferson No. 1	8/13/74	LMF	90 Gals.	RSKERL	
		Jefferson No. 2	8/13/74	LMF	97.5 Gals.	RSKERL	
	Mini-Sampler 2 Mo. equiv.	Carrollton	7/30-31/74	LMF	62 liters	HNF	HNF-SERL
		Jefferson No. 1	7/31-8/1/74	LMF	65 liters	HNF	HNF-SERL
		Jefferson No. 2	8/1-2/74	LMF	60 liters	HNF	HNF-SERL
		Carrollton (repeat)	8/6-8/74	LMF	58 liters	WSRL	WSRL
	Mini-Sampler	Carrollton	8/6/74	LMF	1 liter	HNF	HNF-SERL
		Jefferson No. 1	8/6/74	LMF	1 liter	HNF	HNF-SERL
		Jefferson No. 2	8/6/74	LMF	1 liter	HNF	HNF-SERL

TABLE I (CONTINUED)

DISTRIBUTION OF WORK OPERATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

Sampling Method	Method Modification	Plants Sampled	Dates Sampled	Sampled By	Water Volume	Sample Prepared By	Analysis By
XAD Resin Adsorp. with Ethyl Ether Extraction	Developed by Greg Junk	Carrollton	7/30-8/1/74	LMF-Junk	318 liters	Junk-SERL	SERL
		Jefferson No. 1	7/30-31/74	LMF-Junk	365 liters	Junk-SERL	SERL
		Jefferson No. 2	7/31-8/1/74 7/31-8/1/74	LMF	275 liters	Junk-SERL	SERL
Liquid-Liquid Contact Extract.	Tetralin Solvent	Carrollton	7/31/74	SERL-LMF	3 ea. X 1 lit.	SERL	SERL
		Jefferson No. 1	7/30/74	SERL-LMF	3 ea. X 1 lit.	SERL	SERL
		Jefferson No. 2		LMF	3 ea. X 1 lit.	SERL	SERL
Reverse Osmosis	Cellulose Acetate Membrane in Series with Dupont Permasep Membrane	Carrollton	8/7-9/74	GSRI	Approx. 400 Gals.	WSRL	WSRL
Volatile Stripping	Bellar Technique for Volatile Organics Analysis (VOA)	Carrollton	9/23/74	GSRI	50 ml vials	WSRL	WSRL

Key to abbreviations used in Table I

LMF : Lower Mississippi River Facility (Region VI EPA) Slidell, Louisiana
SERL : Southeast Environmental Research Laboratory (EPA; NERC-Corvallis) Athens, Georgia
RSKERL: Robert S. Kerr Environmental Research Laboratory (EPA; NERC-Corvallis) Ada, Oklahoma
WSRL : Water Supply Research Laboratory (EPA; NERC-Cincinnati) Cincinnati, Ohio
GSRI : Gulf South Research Institute, New Orleans, Louisiana
HNF : Houston Facility (Region VI, EPA) Houston, Texas

ANALYTICAL RESULTS

The trace organic compounds or organic isomers of undetermined specific structure which have been identified by one or more methods in samples derived from the finished water at the Carrollton Water Plant (New Orleans, Louisiana), Jefferson Parish No. 1 Water Plant (Metairie, Louisiana), and Jefferson Parish No. 2 Water Plant (Marerro, Louisiana) are listed in Table 2. Supporting data for these identifications exist at the Water Supply Research Laboratory (Cincinnati, Ohio) or at the Southeast Environmental Research Laboratory (Athens, Georgia).

These compounds are listed in Table 2 in the alphabetical order of their capitalized letter with the single exception of compound 10. The reason for its listing out of order will be explained below. Each compound is numbered in the order of its listing in Table 2. Any reference to a compound in this discussion will be by its assigned number unless a reason exists to refer to the name.

No specific chemical nomenclature system is used in this list of compounds. The name used for a specific compound is the name most generally used for it or by which it might be most readily recognized. For example, compound 2 is called acetone although it might also be named dimethyl ketone or propanone.

The chemical composition of compound 10 is closely related to that of compound 9. Compound 9 is named preferentially by its common name, but its name in the IUPAC nomenclature system is given in parenthesis.

The IUPAC name for compound 10 is also given in parenthesis to show its close relationship to compound 9 and where the difference in chemical composition exists. Compound 10 is given a coined name derived from the common name of compound 9 which shows this difference. This discussion is felt to be necessary to provide assurance that a typographical error has not been made in the common name given for compound 10 and to explain its listing out of alphabetical order.

Where the name given for a particular compound is followed by the term isomer, manual or computerized interpretation of the mass spectral data did not permit the analysts to determine precisely which one of more than one possible molecular isomers bearing that name was present. In some instances, as for example compounds 3 through 8, it was only possible to distinguish the compound class such that specific names could not be provided. Where the specific isomer was determined, as for example compound 43, this was normally confirmed by a gas chromatographic retention time match of an available standard of the compound with the subject peak on the sample chromatogram.

Also given for most compounds in Table 2 is a quantitative value representing the "highest measured concentration" in micrograms per liter (ppb). With the exceptions of compounds 18 and 27 (which were obtained by the Volatile Organics Analysis technique directly from water) all concentration values were obtained from quantitative analyses of carbon chloroform extracts and related back to the water medium. This could be done since the precise volumes of water through the carbon

units was known. That is to say that an expressed concentration value of 1.0 µg/l means 1.0 µg/l in the water from which the sample was derived.

In order to express precise concentration values in the water, however, it would be necessary to know the efficiency values for every stage of the sample collection, preparation, and analytical process. That is, one would have to be able to measure with standards for each compound the efficiency of the carbon adsorption from water, losses incurred in carbon drying, efficiency of desorption by solvent from the carbon, and losses incurred in concentrating the solvent to a low volume. For this project, determination of these efficiencies could be considered an impossible or, at least, infeasible task. Consequently, it is emphasized by the analysts that the concentration values reported must not be interpreted as absolute concentration levels present in the water, but simply represent the highest concentration values measured by them. The term "highest" is used because when values determined by two or more different methods gave values which differed to some extent, the higher or highest of the values was reported in the tabulation. All values are available in the analysts' records.

The analysts also recognize that all of the specific organic compounds identified and reported herein were, in the final stage of analysis, analyzed by some modification of gas chromatography. For a compound to be analyzed by this method, it must have some degree of volatility under the conditions of analysis. Consequently non-volatile organic substances would not have been detected under the analytical conditions employed.

TABLE 2

ORGANIC COMPOUND IDENTIFICATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

	Compound	Highest Measured Concentration µg/l (ppb) Carrollton Water Plant	Jefferson # 1 Water Plant	Jefferson # 2 Water Plant
1	Acetaldehyde	D-VOA	NE	NE
2	Acetone	D-VOA	NE	NE
3	Alkylbenzene-C_2 isomer	0.05	ND	ND
4	Alkylbenzene-C_2 isomer	0.33	ND	ND
5	Alkylbenzene-C_2 isomer	0.11	0.03	ND
6	Alkylbenzene-C_3 isomer	0.01	ND	ND
7	Alkylbenzene-C_3 isomer	0.04	0.05	0.02
8	Alkylbenzene-C_3 isomer	0.02	ND	ND
9	Atrazine * (2-chloro-4-ethylamino-6-isopropylamino-s-triazine)	5.0	4.7	5.1
10	Deethylatrazine (2-chloro-4-amino-6-isopropylamino-s-triazine)	0.51	0.27	0.27

TABLE 2 (Continued)

ORGANIC COMPOUND IDENTIFICATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

	Compound	Highest Measured Concentration µg/l (ppb) Carrollton Water Plant	Jefferson # 1 Water Plant	Jefferson # 2 Water Plant
11	Benzyl butyl phthalate*	0.64	0.81	0.73
12	Bromodichloromethane	D-VOA	NE	NE
13	Bromoform *	0.57	ND	ND
14	Butanone	D-VOA	NE	NE
15	Carbon disulfide	D-VOA	NE	NE
16	Carbon tetrachloride	D-VOA	NE	NE
17	bis-2-Chloroethyl ether*	0.07	0.16	0.12
18	Chloroform*	133	NE	NE
19	bis-2-Chloroisopropyl ether *	0.18	0.05	0.03
20	n-Decane *	0.04	ND	ND
21	Decane-branched isomer	0.03	ND	ND

TABLE 2 (Continued)

ORGANIC COMPOUND IDENTIFICATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

		Highest Measured Concentration µg/l (ppb)		
	Compound	Carrollton Water Plant	Jefferson # 1 Water Plant	Jefferson # 2 Water Plant
22	Dibromodichloroethane isomer [c]	0.33	ND	0.63
23	Dibromochloromethane *	1.1	0.30	0.60
24	Dibutyl phthalate *	0.10	0.16	0.19
25	2,6-Di-t-butyl-p-benzoquinone *	0.22	0.19	0.23
26	Dichlorobenzene isomer	0.01	D-RE	ND
27	1,2-Dichloroethane [a]	8	NE	NE
28	Dichloromethane	D-VOA	NE	NE
29	Dieldrin **	0.05	0.07	0.05
30	Diethyl phthalate *	0.03	0.03	0.01
31	Di(2-ethylhexyl) phthalate *	0.10	0.31	0.06
32	Dihexyl phthalate	0.03	ND	ND

TABLE 2 (Continued)

ORGANIC COMPOUND IDENTIFICATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

		Highest Measured Concentration µg/l (ppb)		
	Compound	Carrollton Water Plant	Jefferson # 1 Water Plant	Jefferson # 2 Water Plant
33	Dihydrocarvone	0.14	0.06	0.07
34	Diisobutyl phthalate *	0.59	ND	ND
35	Dimethyl phthalate	0.27	0.13	0.18
36	Dioctyl adipate	0.10	ND	ND
37	Dipropyl phthalate *	0.07	0.13	0.14
38	n-Dodecane *	0.01	ND	ND
39	Endrin **	0.004	NYE	NYE
40	Ethanol	D-VOA	NE	NE
41	o-Ethyltoluene *	ND	0.04	0.02
42	p-Ethyltoluene *	0.02	0.03	0.03
43	1, 2, 3, 4, 5, 7, 7-Heptachloronorbornene *	0.06	0.05	0.05

TABLE 2 (Continued)

ORGANIC COMPOUND IDENTIFICATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

		Highest Measured Concentration µg/l (ppb)		
	Compound	Carrollton Water Plant	Jefferson # 1 Water Plant	Jefferson # 2 Water Plant
44	Heptachloronorbornene isomer	0.06	0.04	0.04
45	Hexachloro-1,3-butadiene *	0.16	0.27	0.21
46	Hexachloroethane *	4.4	0.19	0.16
47	Isophorone *	1.5	2.2	2.9
48	Limonene *	0.03	ND	ND
49	Methanol	D-VOA	NE	NE
50	Methylbenzoate	ND	D-RE	ND
51	3-Methylbutanal	D-VOA	NE	NE
52	2-Methylpropanal	D-VOA	NE	NE
53	n-Nonane *	0.03	ND	ND
54	n-Pentadecane *	0.02	ND	ND

TABLE 2 (Continued)

ORGANIC COMPOUND IDENTIFICATIONS

NEW ORLEANS AREA WATER SUPPLY STUDY

		Highest Measured Concentration µg/l (ppb)		
	Compound	Carrollton Water Plant	Jefferson # 1 Water Plant	Jefferson # 2 Water Plant
55	Tetrachloroethane isomer	0.11	ND	ND
56	Tetrachloroethylene	D	0.5	0.41
57	n-Tetradecane *	0.02	ND	ND
58	Toluene *	0.08	0.10	ND
59	1,1,2-Trichloroethane *	0.35	0.45	0.41
60	1,1,2-Trichloroethylene	D-VOA	NE	NE
61	n-Tridecane *	0.01	ND	ND
62	Trimethyl-trioxo-hexahydrotriazine isomer	0.07	ND	ND
63	Triphenyl phosphate *	0.12	ND	ND
64	n-Undecane *	0.02	ND	ND
65	Undecane-branched isomer	0.04	ND	ND
66	Undecane-branched isomer	0.06	ND	ND

KEY TO SYMBOLS USED IN TABLE 2

Symbols used in column headed Compound

* While all compounds listed in the table were identified by one or more methods, those marked with this symbol gained added confirmation by gas chromatography retention time match with an available standard of the compound.

** Compounds marked with this symbol gained further confirmation by gas chromatography retention time match with available standards on each of three different columns, polar and non-polar.

a The quantitative values for these compounds were obtained on Volatile Organics Analysis by comparison with standards of known concentration at the Water Supply Research Laboratory. Compound 18 was detected but not quantified in Tetralin extracts of Carrollton water at Southeast Environmental Laboratory, but not in Tetralin extracts of Jefferson No. 1 or Jefferson No. 2. The latter laboratory did not detect compound 27.

Symbols used in columns headed Highest Concentration Measured.

D-VOA These compounds were detected by Volatile Organics Analysis - Bellar Technique only. Quantitative values have not yet been obtained. This method was performed only on the Carrollton water at the Water Supply Research Laboratory.

D-RE These compounds were detected only on XAD resin extracts in the specific water for which this symbol is used. Quantitative values were not obtained from the resin extracts. The compound may have been detected and quantified by another method in one or both of the other waters examined.

D In the one instance where this symbol was used the compound was detected by both the Water Supply Research Laboratory and Southeast Environmental Research Laboratory but not quantified by either laboratory.

NE This symbol means not examined. It is used exclusively for some compounds reported by the Water Supply Research Laboratory. This laboratory did not obtain samples of water from Jefferson No. 1 or Jefferson No. 2.

KEY TO TABLE 2 (CONTINUED)

ND — This symbol means the compound was not detected in that specific water by any of the methods employed.

NYE — Compound 39 was confirmed in Carrollton water carbon chloroform extracts shortly before preparation of this report. Jefferson No. 1 and Jefferson No. 2 extracts have not yet been re-examined specifically for compound 39.

The sampling program as originally assigned to the Lower Mississippi River Facility was completed on schedule in mid-August 1974. The time required in processing of samples for analysis prevented getting the samples to the analysts before mid-August to early September. Thus, the analysts have had only eight to ten weeks to perform extremely complex and demanding analyses while maintaining precise control over sample integrity and adhering to scientifically defensible techniques. Nevertheless, the Analytical Chemistry Branch of the Southeast Environmental Research Laboratory which has handled the greatest portion of the analytical work-load, estimates that their committment is 80% complete and that a final technical assistance report will be submitted to the Region VI Administrator by early December 1974.

The SERL staff will continue their work toward obtaining some additional confirmatory evidence and quantitative estimates on the carbon chloroform extracts and in particular will examine the 2 month equivalent and 1 day equivalent Mini-sample extracts which they have had no opportunity to examine as yet.

The Water Supply Research Laboratory, which performed some of the additional analytical work not in the original program, made no definite committment to the initial project plan, but has provided valuable assistance in developing confirmatory evidence for some

compounds identified at SERL and, through the VOA technique, detected the presence of others which would most likely not have been detected through the carbon adsorption methods alone for various technical reasons.

It is doubtful that any analytical data for this project will be forthcoming from the Reverse Osmosis sampling technique. This technique, still in a developmental stage as a sampling method for trace organics concentration, will probably require further study and development at the research level before it can be relied on to produce the type of valid data required of it.

The Liquid-Liquid contact extraction with tetralin solvent was also a sparse source of data, although a few confirmatory identifications were derived from it. No reliable quantitative estimates were obtained and it is not expected to be a source of any additional data.

No commitment to the analysis of the CAM 10 year equivalent or CAM 1 year equivalent samples could be obtained. These samples have been extracted with chloroform and are at present being stored in sealed vials under refrigeration at the Robert S. Kerr Environmental Research Laboratories. If analyses are to be required for these samples, additional analytical assistance will need to be sought.