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Upper Great Lakes Connecting Channels Interlaboratory QA/QC Study - QM-1: PCBs, OCs and CHs in Ampules - Final Report

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UPPER GREAT LAKES CONNECTING CHANNELS INTERLABORATORY PERFORMANCE EVALUATION STUDY QM-1: PCBs, OCs and CHs in AMPULES FINAL REPORT

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ABSTRACT

The Upper Great Lakes Connecting Channels (UGLCC) Study recognizes Quality Assurance/Quality Control (QA/QC) aspects as crucial elements to the overall utility of study results. As part of the QA/QC program, 13 interlaboratory performance evaluation studies were designed and conducted by the Quality Management Work Group.

This report describes the results from the first interlaboratory performance evaluation study, QM-1, which consisted of the analysis of total PCBs, 12 organochlorine insecticides (OC) and 13 chlorinated hydrocarbons (CH) in standard solutions. Results were received from 9 out of 16 participating laboratories (5 Canadian, 4 U.S.).

Overall, the PCB data were accurate and precise. The accuracy and precision of the OC results were good, except for a few parameters. Fewer participants analyzed CHs than OCs, and the overall results were precise, but less accurate than the OCs. Overall most data received from the participants for QM-1 were satisfactory and comparable, except for some of the data submitted by laboratory U063, where precision and accuracy are questionable.

RÉSUMÉ

L'assurance et le contrôle de la qualité (AQ/CQ) sont des éléments essentiels à l'utilité générale des résultats de l'étude sur les canaux reliant les Grands Lacs de la région supérieure. Dans le cadre du programme AQ/CQ, le groupe de travail sur la gestion de la qualité a conçu et mené à bien 13 évaluations comparatives de la performance des laboratoires.

Le présent rapport décrit les résultats de la première évaluation de performance, QM-1, soit l'analyse des PCB totaux, de 12 insecticides organochlorés et de 13 hydrocarbures chlorés en solutions étalons. Neuf laboratoires participants sur 16 ont fait parvenir leurs résultats (5 laboratoires canadiens et 4 américains).

En général, les données sur les BPC étaient exactes et précises. L'exactitude et la précision des résultats sur les insecticides organochlorés étaient bonnes, sauf pour quelques paramètres. Les hydrocarbures chlorés ont été analysés par moins de participants que les insecticides organochlorés et, dans l'ensemble, les résultats étaient précis, mais moins exacts que les données sur les pesticides organochlorés. En général, presque toutes les données envoyées par les participants à l'étude QM-1 étaient valables et compatibles, sauf quelques données du laboratoire UO63, dont la précision et l'exactitude laissaient à désirer.

MANAGEMENT PERSPECTIVE

The Upper Great Lakes Connecting Channels (UGLCC) have been designated "Areas of Concern" by the International Joint Commission. A Canada-U.S. binational study, involving the identification and assessment of the environmental impacts of toxic substances, in those areas, was initiated in 1984. In order to assist analytical laboratories contributing data to the UGLCC study, to generate reliable and accurate data, a Quality Management Work Group was formed and 13 interlaboratory studies were implemented. This report describes the results from the first interlaboratory performance evaluation study, QM-1, which consisted of the analysis of standard solutions of PCB, 12 organochlorine insecticides and 13 chlorinated hydrocarbons. Results were received from 9 out of 16 participating laboratories (5 Canadian, 4 U.S.). Overall, with the exception of one laboratory, most of the data received from the participants were satisfactory and comparable.

PERSPECTIVE GESTION

La Commission mixte internationale a désigné les canaux reliant les Grands Lacs de la région supérieure "secteurs de préoccupation". En 1984, le Canada et les États-Unis ont entrepris une étude conjointe sur la détermination et l'évaluation des effets de substances toxiques sur l'environnement de ces régions. Afin d'aider les laboratoires qui participent à cette étude à présenter des données fiables et précises, on a créé un groupe de travail sur la gestion de la qualité et effectué 13 études interlaboratoires. Le présent rapport décrit les résultats de la première évaluation comparative de la performance des laboratoires, QM-1; dans le cadre de cette étude, on a analysé les PCB totaux, 12 insecticides organochlorés et 13 hydrocarbures chlorés en solutions étalons. Neuf laboratoires participants sur 16 ont fait parvenir les résultats (5 laboratoires canadiens et 4 américains). En général, presque toutes les données reçues étaient valables et compatibles, sauf celles d'un seul laboratoire.

INTRODUCTION

The Upper Great Lakes Connecting Channels (UGLCC) have been designated as "Areas of Concern" by the International Joint Commission (IJC). To identify and deal with the environmental problems, a three year binational study was started in 1984, involving Canadian and U.S. environmental and resource agencies, to study the St. Marys, St. Clair and Detroit Rivers, and Lake St. Clair. The study involves identifying, quantifying and determining the environmental impacts of conventional and toxic substances from various sources.

The UGLCCS recognizes Quality Assurance/Quality Control (QA/QC) aspects as crucial elements to the overall utility of study results. As part of the QA/QC program, 13 interlaboratory performance evaluation (QC) studies were designed and conducted by the Quality Management Work Group. The goal of these QC studies was to assist analytical laboratories, who are producing data for the UGLCC study, to generate reliable, accurate data and to assess their overall performance during the study. A total of some 100 parameters (organic, inorganic and physical properties) in three types of matrices (water, sediment and biota) will be assessed.

This first interlaboratory study, QM-1, was initiated on December 17, 1985. It involved the analysis of organic parameters (total PCBs, 12 organochlorine insecticides and 13 chlorinated hydrocarbons) in standard solutions. The original deadline for reporting results was set for March 20, 1986. However, several laboratories were late in reporting, so the study was closed on July 4, 1986.

STUDY PROFILE

From the returned questionnaires, the following 16 laboratories affirmed that they would participate in this study: U001, U005, U009, U014, U063, U072, U075, U079, U086, U013, U049, U057, U077, U078, U085 and U090. By the time the study was closed, the last seven laboratories had not sent back any results. See the list of participants at the end of this report.

Since erratic in-house standard solutions had been shown to be the single major source of error in previous interlaboratory studies for organic parameters, the present study was designed to evaluate the accuracy of the participants' calibration standards for total PCBs, organochlorinated insecticides and chlorinated hydrocarbons. These parameters were included since they are usually analyzed simultaneously.

Each laboratory was provided with 12 ampules as described in Table 1. All standard solutions and the above test samples were prepared by the Quality Assurance and Methods Section (QAMS) of the National Water Research Institute (NWRI). Stock solutions of individual Aroclors were obtained from US EPA and those for organochlorines (OCs) and chlorinated hydrocarbons (CHs) were prepared from in-house analytical standards of purity greater than 98%. The design values and interlaboratory medians for each parameter are given in Table 2. The design values of the PCB samples were based on the

labelled concentrations on the US EPA ampules. Those for OCs and CHs were derived gravimetrically when the stock solutions were prepared. The values were also checked against in-house quality control samples from other QC studies by two analysts on different dates. The same PCB and OC samples were also used in IJC Interlaboratory Study 52 involving more than 20 laboratories. The design values of these samples were confirmed by the interlaboratory medians of the IJC study, since the discrepancy between the design value and the median was usually less than 10%. Participants were asked to analyze samples 101-104 for total PCBs, samples 105-108 for 12 OCs (hexachlorobenzene (HCB), α-BHC, γ-BHC, Mirex, p,p'-DDE, p,p'-DDD, p,p'-DDT, heptachlor epoxide, dieldrin, α-chlordane, γ-chlordane, oxychlordane) and samples 109-112 for 13 CHs (1,4-dichlorobenzene (DCB), 1,3-dichlorobenzene (DCB), 1,2-dichlorobenzene (DCB), 1,3,5-trichlorobenzene (TCB), 1,2,4-trichlorobenzene (TCB), 1,2,3-trichlorobenzene (TCB), 1,2,4,5-tetrachlorobenzene (TeCB), 1,2,3,4-tetrachlorobenzene (TeCB), pentachlorobenzene (PeCB), hexachlorobenzene (HCB), hexachloroethane (HCE), hexachlorobutadiene (HCBD), octachlorostyrene). In order to provide a rough indication of the precision of such analyses, these samples were sent out in blind duplicate pairs as shown in Table 1.

RESULTS AND DISCUSSION

Analytical Methodology

All standard solutions could be quantified by direct injection into a gas chromatograph using an electron-capture detector and a suitable column. For the analysis of PCBs, five out of nine reporting laboratories used packed columns while the rest used capillary columns. In most cases, PCB quantitation was done by summation of individual peaks of Aroclors 1242, 1254 and 1260. All laboratories except U072 and U079 used capillary columns for OC analysis and all participating laboratories used capillary columns for CH analysis. See Table 3 for details of the method of detection.

Data Evaluation

All raw data submitted by the participants are listed by parameter in the data summary (Appendix II). Individual lab results for total PCBs were evaluated by the Youden ranking technique (1) for the detection of bias, as well as a computerized flagging procedure (2). A laboratory's results are judged biased high or low, when its total rank is outside of a statistically allowable range. Results are flagged very low, low, high or very high, when they deviate significantly from the interlaboratory median. For a further

explanation of the ranking and flagging procedure, see Appendix I. This statistical procedure, which semi-quantitatively evaluates data accuracy is widely used in other interlaboratory QC studies. See Table 5 for a summary of the PCB data ranking and flagging.

This procedure was not used to evaluate the OCs or CHs, since the number of samples analyzed was limited (4) or, the number of reporting laboratories was small (<9) and varied for each parameter. Also in some cases, because of the small number of reported results and the presence of outliers, the median did not reflect the design value. To evaluate the precision and accuracy of OC and CH results in this study, the percent recoveries (reported vs design values or interlaboratory medians) were calculated (Table 4).

To provide a semi-quantitative evaluation of the results, the results were designated as very low, low, high and very high, based on the reported results as a % of the design value as shown below:

$\geq$ 150%	very high
149%-125%	high
124%-76%	satisfactory
75%-51%	low
$\leq$ 50%	very low

See Table 6 for a summary of each laboratories results.

General Comments

Only three of the nine reporting laboratories reported their data by the originally set deadline (U075, U079, U086). Computer printouts with the raw data were sent to all reporting laboratories for verification in April 1986. All laboratories except U063 returned their results verified. A final data summary was sent to the participating labs, the Quality Management Work Group, the work group chairmen and the MC and AIC chairmen on July 11, 1986.

After reviewing the data summary containing all of the laboratories' data, laboratory U063 discovered some anomalies in their previously reported data and submitted some updated results for OCs and CHs on August 6, 1986. These late changes were not incorporated into this report, but can be found in Appendix III.

The overall interlaboratory performance of total PCB analysis was satisfactory. For the four test samples, the interlaboratory medians agreed closely with the design values and the between-lab RSD ranged from 12 to 21%. The precision of duplicate PCB analysis was very good. Despite the various quantitative techniques used by the participants, these results indicated that PCB data in this study are generally comparable and accurate. It is of interest to note that the reported detection limits for PCBs among the participants varied from 0.5 to 100 pg/μL, a 200-fold difference. It is likely that the low detection limit was based on an individual PCB congener and the high detection limit was based on total PCBs.

Only three laboratories, namely U009, U063, U072 analyzed all 12 OCs in samples 105 to 108 as requested. Many laboratories do not analyze α-BHC and oxychlordane routinely. Due to the presence of outlying data from laboratory U063, there was a >40% difference between the interlaboratory mean and the median for α-BHC, mirex, heptachlor epoxide, dieldrin and α-chlordane for some samples (see Appendix II). Agreement between design values and interlaboratory medians for all OCs was good, although the medians were more than 10% lower than the design values in the cases of HCB, p,p'-DDE, p,p'-DDD and p,p'-DDT. After rejection of outliers, the interlaboratory RSD for OCs were less than 20%, indicating comparability of results between the participants. Except for laboratory U063's results for some OC parameters, precision of within-lab OC analysis was again very good for all participants since the difference between duplicate analysis was usually <10%. The reported detection limits for the OCs ranged from 0.1 to 50 pg/μL.

There were fewer participants analyzing CHs than OCs in QM-1. Only laboratories U072 and U086 provided results on all 13 components in samples 109 to 112. Laboratory U001 reported results for all chlorobenzenes except 1,2,4,5-TeCB, HCE, HCBD and octachlorostyrene. The other laboratories only analyzed some of the parameters. The difference between design values and interlaboratory medians in the test samples was about 10% for the dichlorobenzenes, HCB, HCE, HCBD and octachlorostyrene. For the other CHs, the interlaboratory medians

were 20% or more lower than the design values. The cause of this discrepancy is uncertain, however, an outlying result in a small data set can change the median significantly. Other than a few minor exceptions, the precision of duplicate within-lab CH analyses was again very good. On the other hand, the between-lab comparability of data was less satisfactory for CHs than OCs since the interlaboratory RSD's are greater than 25% in many cases. It should be noted that the reported detection limits for the CHs ranged from 0.1 to 300 pg/μL, a 3000-fold difference.

Lab-Specific Comments

See definitions of low, very low, high and very high on page 5.

U001

Overall, data were satisfactory. Most results were fairly accurate (75-109% recovery). Precision, between duplicate results was within ±10% in most cases. There were six parameters which contained outlying low results (<75% of the design value), one OC and five CHs (see Table 6). Five parameters were not analyzed (oxychlordane, 1,2,4,5-TeCB, HCE, HCBD, octachlorostyrene). No detection limits were reported.

U005

There were eight parameters which contained high or low results (see Table 6). Two total PCB results were flagged (sample 101-high and sample 103-very high). All OC results were precise (within ±10%) and the accuracy was satisfactory except for HCB and p,p'-DDD. The CH results were not as precise or accurate since some values were close to the lab's detection limit. Seven out of thirteen reported results were T coded (see Appendix I for explanation of T code). The presence of four CHs (1,2,4-TCB, HCB, HCE and HCBD) were not detected. No results were provided for the following seven parameters (α-BHC, 1,3,5-TCB, 1,2,3-TCB, 1,2,4,5-TeCB, 1,2,3,4-TeCB, PeCB and octachlorostyrene), since they were not routinely analyzed by the lab.

U009

The PCB results of this lab were precise and slightly high when compared to the design values. The OC results were also precise and generally accurate (between 80 and 100% of the design values) except for HCB and heptachlor epoxide which were low and oxychlordane which was high. On the other hand, many of the CH results were low (<50% recovery) and those for 1,3,5- and 1,2,4-TCB as well as 1,2,4,5-TeCB were particularly low. No values were reported for the dichlorobenzenes since they were not currently included in their methodology.

U014

Total PCBs were flagged very high for sample 101, high for both samples 102 and 103, and the entire set of PCB data was determined biased high using the Youden ranking. The OCs were fairly accurate 90-109% recovery, except for Mirex and heptachlor epoxide which were high (138%) and very high (>150%), respectively. Five out of seven CHs were high and the precision overall was within ±10%. Analysis for α-BHC, oxychlordane, 1,3,5-TCB, 1,2,3-TCB, 1,2,4,5-TeCB, 1,2,3,4-TeCB, PeCB and octachlorostyrene was not conducted.

U063

In general, several of this laboratory's results were erratic. Seventy-four percent (17 out of 23) of the parameters analyzed had at least one high or low result. Total PCB data was precise within ±5% and also had no flags. For the OCs the precision was poor, in some cases the RSD was as high as 130% (dieldrin). The accuracy of some parameters in some samples was also poor, ranging from 60.1%-2142% recovery of the design value. For the CHs, sample 112 was not analyzed although the blind duplicate (sample 109) was. Hence the precision for this laboratory cannot be evaluated for this sample pair. For the other two samples (110 and 111), the precision between duplicates was satisfactory (within ±10%). However, the accuracy in most cases was poor, ranging from 41.7% - 17,500% recovery of the

design value. Pentachlorobenzene results were out of control, as all three samples analyzed were greater than 10000% recovery from the design value. Hexachloroethane, hexachlorobutadiene and octachlorostyrene were not analyzed. No raw data verification was returned. When contacted by telephone, the laboratory requested to have their results remain as reported. See Appendix III for changes reported on August 6, 1986 (these changes are not used in this report). However, for the changes made for the OCs, all were satisfactory, except for α-chlordane which was high (138% recovery). Missing results were submitted for CHs for sample 112. Nine out of ten parameters were either high or low. Overall, the precision improved.

U072

Overall, this laboratory's performance was excellent for most parameters. For total PCB, accuracy was within ±20% of the design value, and precision between duplicates was within ±5%. OC and CH results were also accurate, and precision was within ±10%. Only for sample 112, the result for 1,2,4-TCB was high.

U075

This laboratory submitted data for only four parameters. For this study, these are the only common parameters which they are analyzing and reporting for the UGLCC study. The precision between duplicates for the total PCB and the two CHs was within ±10%. Sample

101 for total PCB was flagged low. The accuracy was good for the two CHs reported (84-101% recovery of design value). The low HCB result (54% recovery), in sample 108, was likely due to a random error.

U079

Only five parameters were analyzed. Total PCB was accurate and precision was within ±5%. HCB, p,p'-DDE and γ-BHC were precise within ±10% and also accurate. For sample 105, p,p'-DDT was on the low side. No chlorinated hydrocarbons were analyzed.

U086

Overall, this laboratory's accuracy was less satisfactory. Eighty-two percent of the parameters analyzed had some low values when compared to the design values. Total PCB data was accurate and precision was within ±10%. For the OCs the precision was in most cases good, but the accuracy was poor in most cases. Recovery of p,p'-DDD was <40% of the design value. Four parameters were not quantified (heptachlor epoxide, dieldrin, α-chlordane and oxychlordane). The CHs were all low except hexachloroethane. The precision was within ±5%.

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Michigan Department of Public Health, Lansing, Michigan

National Water Research Institute, ECD, Burlington, Ontario

Ontario Ministry of the Environment, Rexdale, Ontario

US EPA, GLNPO, The Bionetics Corp., Chicago, Illinois

Water Quality National Laboratory, Burlington, Ontario

Zenon Environmental Inc., Burlington, Ontario

The following laboratories were given samples, but did not submit any results:

Barringer Magenta, Rexdale, Ontario

NWRI, ECD, Burlington, Ontario

US Army Corps of Engineers, Detroit, Michigan

US EPA, Large Lakes Research, Grosse Ile, Michigan

US Geological Survey, Arvada, Colorado

IEC Beak Consultants, Mississauga, Ontario } Volunteer laboratories

Mann Testing Laboratory, Mississauga, Ontario

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Table 1. Samples distributed for analysis in QM-1.

Sample	Description
101	1:1:1 mixture of Aroclors 1242/1254/1260 in isooctane
102	2:1 mixture of Aroclors 1254/1260 in isooctane
103	same as 101
104	same as 102
105	mixture of 7 OCs in isooctane
106	mixture of 5 OCs in isooctane
107	same as 106
108	same as 105
109	mixture of 13 CHs in isooctane
110	sample 109 after dilution to 15%
111	same as 110
112	same as 109

Table 2. Design values and interlaboratory medians for PCBs, OCs and CHs. All values are in pg/μL.

PCBs	Sample Number 101 & 103			Sample Number 102 & 104		
	Design Value	Interlab Median 101	103	Design Value	Interlab Median 102	104
Total PCBs	1550	1550	1490	180	190	200
Organochlorines	**Sample Number 105 & 108**			**Sample Number 106 & 107**		
	Design Value	Interlab Median 105	108	Design Value	Interlab Median 106	107
HCB	51.8	39.5	40.0	-		-
Alpha-BHC	26.2	23.6	22.1	-		-
Gamma-BHC	24.9	24.25	21.35	-		-
Mirex	54.3	49.3	48.0	-		-
p,p'-DDE	111.4	98.0	94.5	-		-
p,p'-DDD	50.4	43.1	36.2	-		-
p,p'-DDT	50.9	45.8	44.0	-		-
Heptachlor epoxide	-	-	-	39.5	41.05	38.5
Dieldrin	-	-	-	43.0	41.9	39.0
Alpha-Chlordane	-	-	-	52.6	53.55	55.0
Gamma-Chlordane	-	-	-	48.9	47.4	49.0
Oxychlordane	-	-	-	24.5	26.95	25.55
Chlorinated Hydrocarbons	**Sample Number 109 & 112**			**Sample Number 110 & 111**		
	Design Value	Interlab Median 109	112	Design Value	Interlab Median 110	111
1,4-Dichlorobenzene	1013	958.0	978.0	152	146.0	143.0
1,3-Dichlorobenzene	952	890.5	903.0	143	134.0	131.0
1,2-Dichlorobenzene	1050	1001.5	957.0	158	155.0	150.0
1,3,5-Trichlorobenzene	213	152.0	142.5	32.0	23.7	23.5
1,2,4-Trichlorobenzene	200	183.5	146.0	30.0	24.05	23.65
1,2,3-Trichlorobenzene	208	155.0	144.0	31.2	24.4	24.1
1,2,4,5-Tetrachlorobenzene	101	55.25	62.0	15.1	8.5	9.04
1,2,3,4-Tetrachlorobenzene	97.9	70.1	67.45	14.7	11.1	11.0
Pentachlorobenzene	98.6	77.15	74.4	14.8	12.6	12.1
Hexachlorobenzene	51.8	44.6	45.0	7.77	7.20	6.70
Hexachloroethane	40.1	37.9	39.75	6.02	5.50	5.50
Hexachlorobutadiene	49.5	46.6	46.8	7.42	7.10	6.80
Octachlorostyrene	104	85.75	89.5	15.6	13.75	12.85

Table 3a Analytical Methodology for Total PCBs.

Lab No.	GC Column Type and Detector		Quantitation
U001	3% OV-101 packed column	EC	Aroclors 1248:1254:1260 1 : 1 : 1
U005	3% SP-2100 on Supelcoport - quantitation 1.5% SP-2250/1.95% SP-2401 on Supelcoport-confirmation	EC	Individual Aroclors are summed
U009	4m x 2 mm Dexsil 300 packed	EC	Designated peak summation (Aroclor)
U014	25 m x 0.2 mm HP SE-54 capillary column	^{63}NiEC	Sum aroclors (7-10 peaks each) 1242,1254, 1260
U063	30 m x .25 mm ID DB-1	EC	
U072	2 m x 2 mm ID 3% SE-30 packed	^{63}NiEC	Peak height compared to known stds.
U075	30 m DB-5 column		On average of 25 peaks based on 1:1:1 1242:1254:1260
U079	6'x 2 mm ID 1.5% SP-2250/ 1.95% SP-2401 packed	EC	Summed individual Aroclors 1242, 1254, 1260
U086	2-30 m capillary columns - DB-5 and DB-17	2-EC	Individual PCB congeners were quantified and summed.

Table 3b Analytical Methodology for Organochlorines and Chlorinated Hydrocarbons.

Lab No.	GC Column Type	Detector
U001	30 m SPB-5 column	Ni^{63} EC
U005	Dual capillary column: for OCs DB-17, 30 m x 0.25 mm ID - analytical capillary SPB-5, 30 m x 0.25 mm ID - confirmatory capillary for CHs: GC/MS 30 m x 0.25 mm ID DB-5 capillary column	EC
U009	Dual capillary DB-1701, DB-1	EC
U014	25 m x 0.2 mm HP SE-54 Capillary column	^{63}Ni EC
U063	30 m x .25 mm ID DB-1 column	EC
U072	2 m x 2 mm ID, 3% SE-30 packing: OCs 30 m x 0.32 mm fused silica, coating - DB-5: CHs	^{63}Ni EC ^{63}Ni EC
U075	30 m DB-5 column	no details given
U079	6'x 2 mm ID column packed - OCs 1.5% SP-2250/1.9% SP-2401	EC
U086	2-30 m capillary columns - DB-5 and DB-17	EC

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U001 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	95.3	96.7	109	105	92.3	97.3	104	94.5
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	76.3	77.2	-	-	100	100	-	-
Alpha-BHC	98.1	84.4	-	-	109	100	-	-
Gamma-BHC	96.8	83.1	-	-	99.4	97.0	-	-
Mirex	79.0	75.1	-	-	87.0	85.0	-	-
p,p'-DDE	88.3	82.8	-	-	100	97.6	-	-
p,p'-DDD	80.2	71.8	-	-	93.7	100	-	-
p,p'-DDT	91.7	86.4	-	-	102	100	-	-
Heptachlor epoxide	-	-	106	105	-	-	102	107
Dieldrin	-	-	95.1	89.5	-	-	97.6	98.7
Alpha-Chlordane	-	-	87.8	87.5	-	-	86.3	83.6
Gamma-Chlordane	-	-	78.3	76.3	-	-	80.8	76.1
Oxychlordane	-	-	NA	NA	-	-	NA	NA
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	94.2	96.5	96.1	94.1	99.6	100	100	100
1,3-Dichlorobenzene	92.5	94.9	93.7	91.6	98.9	100	100	100
1,2-Dichlorobenzene	88.9	91.1	89.9	88.0	93.2	100	91.6	92.7
1,3,5-Trichlorobenzene	71.4	72.8	74.1	73.4	100	109	100	100
1,2,4-Trichlorobenzene	71.0	73.0	75.0	74.3	77.4	100	93.6	94.3
1,2,3-Trichlorobenzene	74.5	76.0	78.2	77.2	100	110	100	100
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4-Tetrachlorobenzene	68.8	70.9	75.5	74.8	96.1	103	100	100
Pentachlorobenzene	74.0	77.9	82.4	81.8	94.6	103	96.8	100
Hexachlorobenzene	86.1	86.9	94.5	94.0	100	100	102	109
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorostyrene	NA	NA	NA	NA	NA	NA	NA	NA

*See Appendix I for an explanation of codes used.

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U005 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	134	142	104	111	130	143	98.4	100
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	48.3	50.2	-	-	63.3	65.0	-	-
Alpha-BHC	NRA	NRA	-	-	NRA	NRA	-	-
Gamma-BHC	80.3	84.3	-	-	82.5	98.4	-	-
Mirex	88.4	88.4	-	-	97.4	100	-	-
p,p'-DDE	81.7	84.4	-	-	92.9	99.5	-	-
p,p'-DDD	53.6	53.6	-	-	62.6	74.6	-	-
p,p'-DDT	80.6	80.6	-	-	89.5	93.2	-	-
Heptachlor epoxide	-	-	83.5	86.1	-	-	80.4	88.3
Dieldrin	-	-	74.4	79.1	-	-	76.4	87.2
Alpha-Chlordane	-	-	98.9	105	-	-	97.0	100
Gamma-Chlordane	-	-	77.7	79.8	-	-	80.2	79.6
Oxychlordane	-	-	93.9	98.0	-	-	85.3	93.9
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	82.9	63.2	78.9(T)	72.4(T)	87.7	65.4	82.2(T)	76.9(T)
1,3-Dichlorobenzene	77.7	63.0	69.9(T)	90.9(T)	83.1	66.4	74.6(T)	99.2(T)
1,2-Dichlorobenzene	77.1	67.6	69.6(T)	75.9(T)	80.9	74.2	71.0(T)	80.0(T)
1,3,5-Trichlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
1,2,4-Trichlorobenzene	125(T)	ND	ND	ND	136(T)	ND	ND	ND
1,2,3-Trichlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
1,2,4,5-Tetrachlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
1,2,3,4-Tetrachlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
Pentachlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND
Octachlorostyrene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA

*See Appendix I for an explanation of codes used.

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U009 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	127	117	122	122	123	118	116	110
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	68.7	74.5	-	-	90.1	96.5	-	-
Alpha-BHC	90.0	93.1	-	-	100	110	-	-
Gamma-BHC	98.0	98.0	-	-	101	114	-	-
Mirex	95.8	95.8	-	-	105	108	-	-
p,p'-DDE	80.6	81.5	-	-	91.6	96.1	-	-
p,p'-DDD	99.2	101	-	-	116	141	-	-
p,p'-DDT	102	100	-	-	114	116	-	-
Heptachlor epoxide	-	-	65.3	62.8	-	-	62.9	64.4
Dieldrin	-	-	91.6	90.2	-	-	94.0	99.5
Alpha-Chlordane	-	-	103	106	-	-	101	101
Gamma-Chlordane	-	-	96.9	100	-	-	100	100
Oxychlordane	-	-	150	144	-	-	137	139
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
1,3-Dichlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
1,2-Dichlorobenzene	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
1,3,5-Trichlorobenzene	25.2	23.0	32.2	29.4	35.3	34.3	43.5	40.0
1,2,4-Trichlorobenzene	47.1	41.9	53	46.3	51.3	57.3	66.1	58.8
1,2,3-Trichlorobenzene	61.1	54.8	70.2	59.0	82.0	79.1	89.8	76.3
1,2,4,5-Tetrachlorobenzene	45.8	38.7	38.4	33.8	83.8	63.1	68.2	56.4
1,2,3,4-Tetrachlorobenzene	71.6	66.9	87.1	76.9	100	97.1	115	103
Pentachlorobenzene	82.5	73.0	85.1	73.6	105	96.8	100	90.1
Hexachlorobenzene	72.4	65.6	92.7	75.9	84.1	75.6	100	88.1
Hexachloroethane	93.0	81.0	81.4	74.8	98.4	81.8	89.1	81.8
Hexachlorobutadiene	91.3	81.0	90.3	82.2	97.0	85.7	94.4	89.7
Octachlorostyrene	69.7	61.6	87.2	70.5	84.5	71.6	98.9	85.6

*See Appendix I for an explanation of codes used.

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U014 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	135	125	131	130	131	126	124	117
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	96.5	96.5	-	-	127	125	-	-
Alpha-BHC	NA	NA	-	-	NA	NA	-	-
Gamma-BHC	100	100	-	-	103	117	-	-
Mirex	138	138	-	-	152	156	-	-
p,p'-DDE	89.8	92.5	-	-	102	109	-	-
p,p'-DDD	107	109	-	-	125	152	-	-
p,p'-DDT	102	102	-	-	114	118	-	-
Heptachlor epoxide	-	-	152	162	-	-	146	166
Dieldrin	-	-	100	100	-	-	103	110
Alpha-Chlordane	-	-	105	105	-	-	103	100
Gamma-Chlordane	-	-	106	106	-	-	110	106
Oxychlordane	-	-	NA	NA	-	-	NA	NA
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	118	118	132	125	125	123	137	133
1,3-Dichlorobenzene	116	116	133	119	124	122	142	130
1,2-Dichlorobenzene	114	124	120	120	120	136	123	127
1,3,5-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	115	115	100	100	125	158	125	127
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	96.5	116	129	129	112	133	139	149
Hexachloroethane	99.8	125	166	166	106	126	182	182
Hexachlorobutadiene	141	141	135	135	150	150	141	147
Octachlorostyrene	NA	NA	NA	NA	NA	NA	NA	NA

*See Appendix I for an explanation of codes used.

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U063 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	83.7	84.4	95.6	99.4	81.0	85.0	90.5	89.5
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	72.2	132	-	-	94.7	171	-	-
Alpha-BHC	469	83.6	-	-	521	99.1	-	-
Gamma-BHC	123	84.7	-	-	123	98.8	-	-
Mirex	425	75.5	-	-	469	85.4	-	-
p,p'-DDE	87.6	73.5	-	-	99.6	86.7	-	-
p,p'-DDD	90.9	71.2	-	-	106	99.2	-	-
p,p'-DDT	102	60.1	-	-	114	69.5	-	-
Heptachlor epoxide	-	-	691	95.4	-	-	665	97.9
Dieldrin	-	-	2142	91.2	-	-	2198	101
Alpha-Chlordane	-	-	297	113	-	-	291	108
Gamma-Chlordane	-	-	124	104	-	-	128	103
Oxychlordane	-	-	117	109	-	-	106	104
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	95.0	NA	80.3	79.6	100	NA	83.6	84.6
1,3-Dichlorobenzene	119	NA	65.9	64.1	128	NA	70.4	69.9
1,2-Dichlorobenzene	146	NA	104	94.9	153	NA	106	100
1,3,5-Trichlorobenzene	139	NA	90.3	89.1	195	NA	122	121
1,2,4-Trichlorobenzene	131	NA	85.3	83.3	142	NA	106	106
1,2,3-Trichlorobenzene	107	NA	82.4	77.9	144	NA	105	101
1,2,4,5-Tetrachlorobenzene	49.0	NA	46.4	46.9	89.6	NA	82.4	78.3
1,2,3,4-Tetrachlorobenzene	117	NA	70.1	68.0	164	NA	92.8	90.9
Pentachlorobenzene	17526	NA	10736	10270	22399	NA	12611	12562
Hexachlorobenzene	81.7	NA	44.5	41.7	94.8	NA	48.1	48.4
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorostyrene	NA	NA	NA	NA	NA	NA	NA	NA

* See Appendix I for an explanation of codes used.
**See Appendix III for revised results.

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U072 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	107	101	119	119	103	113	101	107
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	85.3	79.3	-	-	112	103	-	-
Alpha-BHC	84.4	90.5	-	-	93.6	107	-	-
Gamma-BHC	91.6	86.7	-	-	94.0	101	-	-
Mirex	90.8	92.1	-	-	100	104	-	-
p,p'-DDE	90.6	90.8	-	-	103	107	-	-
p,p'-DDD	85.5	88.7	-	-	100	123	-	-
p,p'-DDT	88.2	87.6	-	-	98.0	101	-	-
Heptachlor epoxide	-	-	102	99.5	-	-	98.4	102
Dieldrin	-	-	99.8	100	-	-	102	110
Alpha-Chlordane	-	-	101	100	-	-	99.2	95.6
Gamma-Chlordane	-	-	102	101	-	-	105	101
Oxychlordane	-	-	103	100	-	-	93.9	95.9
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	102	118	109	105	108	123	113	112
1,3-Dichlorobenzene	94.5	105	101	97.9	101	111	108	107
1,2-Dichlorobenzene	102	114	98.1	98.1	107	125	100	103
1,3,5-Trichlorobenzene	106	122	102	111	148	182	137	151
1,2,4-Trichlorobenzene	113	128	115	115	123	175	143	146
1,2,3-Trichlorobenzene	111	115	106	111	148	167	135	143
1,2,4,5-Tetrachlorobenzene	99.0	109	99.3	99.3	181	177	176	166
1,2,3,4-Tetrachlorobenzene	112	123	105	109	157	178	140	145
Pentachlorobenzene	106	117	105	105	136	155	123	128
Hexachlorobenzene	91.7	97.5	96.5	96.5	107	112	104	112
Hexachloroethane	96.0	103	99.7	99.7	102	104	109	109
Hexachlorobutadiene	97.0	108	101	101	103	114	106	110
Octachlorostyrene	94.7	101	99.4	96.2	115	117	113	117

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U075 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	78.1	89.3	86.7	88.3	75.5	89.9	82.1	79.5
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	84.9	54.1	-	-	111	70.0	-	-
Alpha-BHC	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Gamma-BHC	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Mirex	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
p,p'-DDE	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
p,p'-DDD	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
p,p'-DDT	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Heptachlor epoxide	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Dieldrin	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Alpha-Chlordane	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Gamma-Chlordane	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Oxychlordane	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
1,3-Dichlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
1,2-Dichlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
1,3,5-Trichlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
1,2,4-Trichlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
1,2,3-Trichlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
1,2,4,5-Tetrachlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
1,2,3,4-Tetrachlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Pentachlorobenzene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Hexachlorobenzene	88.8	86.9	83.7	86.2	103	100	90.3	100
Hexachloroethane	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Hexachlorobutadiene	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP	NAPP
Octachlorostyrene	100	101	89.1	87.8	121	117	101	107

*See Appendix I for an explanation of codes used.

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U079 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	103	99.3	106	112	100	100	100	101
Organochlorines	Sample 105	Sample 108	Sample 106	Sample 107	Sample 105	Sample 108	Sample 106	Sample 107
Hexachlorobenzene	91.7	103	-	-	120	134	-	-
Alpha-BHC	NA	NA	-	-	NA	NA	-	-
Gamma-BHC	104	105	-	-	107	122	-	-
Mirex	NA	NA	-	-	NA	NA	-	-
p,p'-DDE	94.3	94.3	-	-	107	111	-	-
p,p'-DDD	NA	NA	-	-	NA	NA	-	-
p,p'-DDT	75.6	84.3	-	-	84.1	97.5	-	-
Heptachlor epoxide	-	-	NA	NA	-	-	NA	NA
Dieldrin	-	-	NA	NA	-	-	NA	NA
Alpha-Chlordane	-	-	NA	NA	-	-	NA	NA
Gamma-Chlordane	-	-	NA	NA	-	-	NA	NA
Oxychlordane	-	-	NA	NA	-	-	NA	NA
Chlorinated Hydrocarbons	Sample 109	Sample 112	Sample 110	Sample 111	Sample 109	Sample 112	Sample 110	Sample 111
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorostyrene	NA	NA	NA	NA	NA	NA	NA	NA

*See Appendix I for an explanation of codes used.

Table 4. % Recovery Calculated from the Design Value and the Median.

Lab No. U086 $\frac{\text{Reported Value}}{\text{Design/Median}} \times 100$

Parameter	% Recovery from Design Value				% Recovery from Interlaboratory Median			
PCBs	Sample 101	Sample 103	Sample 102	Sample 104	Sample 101	Sample 103	Sample 102	Sample 104
Total PCBs	86.0	85.3	83.3	94.4	83.2	85.9	78.9	85.0
Organochlorines	**Sample 105**	**Sample 108**	**Sample 106**	**Sample 107**	**Sample 105**	**Sample 108**	**Sample 106**	**Sample 107**
Hexachlorobenzene	54.1	59.8	-	-	70.9	77.5	-	-
Alpha-BHC	64.9	72.5	-	-	72.0	86.0	-	-
Gamma-BHC	76.3	76.3	-	-	78.4	89.0	-	-
Mirex	66.3	64.5	-	-	73.0	72.9	-	-
p,p'-DDE	67.3	85.3	-	-	76.5	101	-	-
p,p'-DDD	31.7	37.7	-	-	37.1	52.5	-	-
p,p'-DDT	70.7	86.4	-	-	78.6	100	-	-
Heptachlor epoxide	-	-	NA	NA	-	-	NA	NA
Dieldrin	-	-	NA	NA	-	-	NA	NA
Alpha-Chlordane	-	-	NA	NA	-	-	NA	NA
Gamma-Chlordane	-	-	85.9	83.8	-	-	88.6	83.7
Oxychlordane	-	-	NA	NA	-	-	NA	NA
Chlorinated Hydrocarbons	**Sample 109**	**Sample 112**	**Sample 110**	**Sample 111**	**Sample 109**	**Sample 112**	**Sample 110**	**Sample 111**
1,4-Dichlorobenzene	61.2	56.3	72.4	72.4	64.7	58.3	75.3	76.9
1,3-Dichlorobenzene	57.7	59.9	64.3	64.3	61.8	63.1	68.7	70.2
1,2-Dichlorobenzene	58.1	61.0	69.6	69.6	60.9	66.9	71.0	73.3
1,3,5-Trichlorobenzene	61.0	61.0	68.8	68.8	85.5	91.2	92.8	93.6
1,2,4-Trichlorobenzene	55.0	60.0	66.7	63.3	60.0	82.2	83.2	80.3
1,2,3-Trichlorobenzene	62.5	62.5	64.1	64.1	83.9	90.3	82.0	83.0
1,2,4,5-Tetrachlorobenzene	60.4	61.4	66.2	72.8	110	100	118	122
1,2,3,4-Tetrachlorobenzene	58.2	59.2	63.3	64.6	81.3	86.0	83.8	86.4
Pentachlorobenzene	61.9	61.9	64.9	66.2	79.1	82.0	76.2	81.0
Hexachlorobenzene	59.8	59.8	66.9	69.5	69.5	69.0	72.2	80.6
Hexachloroethane	92.2	94.8	83.1	83.1	97.6	95.6	90.9	90.9
Hexachlorobutadiene	64.6	66.7	67.4	66.0	68.7	70.5	70.4	72.1
Octachlorostyrene	70.2	71.2	76.9	76.9	85.1	82.7	87.3	93.4

*See Appendix I for an explanation of codes used.

TABLE 5

PARAMETER [redacted]01 TOTAL PCB : QM-1 PG/UL

QUALITY ASSURANCE AND [redacted]DS SECTION
NATIONAL WATER RESE[redacted]INSTITUTE
BURLINGTON [redacted]RIO

ANALYSIS OF TOTAL PCBs

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR=150.0 BASIC ACCEPTABLE ERROR=35.00 CONCENTRATION ERROR INCREMENT= .20
LABORATORIES YET TO REPORT: U013, U057, U077, U085, U090, U049, U073
LABORATORY RESULTS OMITTED ARE NONE

SAMPLE	101		102		103		104	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
U001	1430.	4.00	197.	6.00	1450.	4.00	189.	4.00
U005	2010. H	8.00	187.	4.00	2130. VH	9.00	200.	5.00
U009	1900. H	7.00	220.	8.00	1760.	7.00	220.	8.00
U014	2030. VH	9.00	235. H	9.00	1870. H	8.00	234.	9.00
U063	1256.	2.00	172.	3.00	1266.	1.00	179.	3.00
U072	1600.	6.00	214.	7.00	1510.	6.00	214.	7.00
U075	1171. L	1.00	156.	2.00	1340.	3.00	159.	1.00
U079	1550.	5.00	190.	5.00	1490.	5.00	201.	6.00
U086	1290.	3.00	150.	1.00	1280.	2.00	170.	2.00
MEDIAN CONC.	1550.000		190.000		1490.000		200.000	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		DETECTION LIMIT
U001	18.00	4.500	4			30
U005	26.00	6.500	4	HVH		5
U009	30.00	7.500	4	H		100
U014	35.00	8.750	4	VHHH	BIASED HIGH	10
U063	9.00	2.250	4			50
U072	26.00	6.500	4			60
U075	7.00	1.750	4	L		25.0
U079	21.00	5.250	4			0.5
U086	8.00	2.000	4			

OVERALL AVERAGE RANK IS 5.000

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		DETECTION LIMIT
U075	7.00	1.750	4	L		60
U086	8.00	2.000	4			0.5
U063	9.00	2.250	4			10
U001	18.00	4.500	4			25.0
U079	21.00	5.250	4			50
U072	26.00	6.500	4			30
U005	26.00	6.500	4	HVH		5
U009	30.00	7.500	4	H		100
U014	35.00	8.750	4	VHHH	BIASED HIGH	

OVERALL AVERAGE RANK IS 5.000

Table 6 **Summary of laboratory results based on the % recovery of the design value. (See page 5).**

Lab No.	Parameter	Comments
U001	p,p'-DDD	Sample 108 - low
	1,3,5-TCB	Samples 109,112,110,111 - low
	1,2,4-TCB	Samples 109,112,110,111 - low
	1,2,3-TCB	Sample 109 - low
	1,2,3,4-TeCB	Samples 109,112,111 - low
	Pentachlorobenzene	Sample 109 - low
U005	Total PCB	Samples 101,103 - high
	Hexachlorobenzene	Samples 105 - v.low; 108 - low
	p,p'-DDD	Samples 105,108 - low
	Dieldrin	Sample 106 - low
	1,4-DCB	Samples 112,111 - low
	1,3-DCB	Samples 112,110 - low
	1,2-DCB	Samples 112,110 - low
	1,2,4-TCB	Samples 109 - high; 112,111, 110 - ND
	Hexachlorobenzene	ND all 4
	Hexachloroethane	ND all 4
	Hexachlorobutadiene	ND all 4
U009	Total PCB	Sample 101 - high
	Hexachlorobenzene	Samples 105,108 - low
	Heptachlor epoxide	Samples 106,107 - low
	Oxychlordane	Samples 106 - v.high; 107 - high
	1,3,5-TCB	Samples 109,112,110,111 - v.low
	1,2,4-TCB	Samples 109,112,111-v.low; 110 - low
	1,2,3-TCB	Samples 109,112,110,111 - low
	1,2,4,5-TeCB	Samples 109,112,110,111 - v.low
	1,2,3,4-TeCB	Samples 109,112 - low
	Pentachlorobenzene	Samples 112,111 - low
	Hexachlorobenzene	Samples 109,112 - low
	Hexachloroethane	Sample 111 - low
	Octachlorostyrene	Samples 109,112, 111 - low
U014	Total PCB	Samples 101,103,102,104 - high
	Mirex	Samples 105,108 - high
	Heptachlor epoxide	Samples 106,107 - v.high
	1,4-DCB	Samples 110,111 - high
	1,3-DCB	Sample 110 - high
	Hexachlorobenzene	Samples 110,111 - high
	Hexachloroethane	Samples 112 - high; 110,111 - v.high
	Hexachlorobutadiene	Samples 109,112,110,111 - high

Table 6 **Summary of laboratory results based on the % recovery of the design value.** **(See page 5).**
continued

Lab No.	Parameter	Comments
U063	Hexachlorobenzene	Samples 105 - low, sample 108 - high
	α-BHC	Sample 105 - v.high (469%)
	Mirex	Sample 105 - v.high (425%)
	p,p'-DDE	Sample 108 - low
	p,p'-DDD	Sample 108 - low
	p,p'-DDT	Sample 108 - low
	Heptachlor epoxide	Sample 106 - v.high (691%)
	Dieldrin	Sample 106 - v.high (2142%)
	α-chlordane	Sample 106 - v.high (297%)
	1,3-DCB	Samples 110,111 - low
	1,2-DCB, 1,2,4-TCB and 1,3,5-TCB	Sample 109 - high
	1,2,4,5-TeCB	Samples 109,110,111 - v.low
	1,2,3,4-TeCB	Samples 110,111 - low
	Pentachlorobenzene	Samples 109,110,111 - v.high (>10,000%)
	Hexachlorobenzene	Samples 110,111 - v.low
U072	1,2,4-TCB	Sample 112 - high
U075	Hexachlorobenzene (only 4 parameters analyzed)	Sample 108 - low
U079	No chlorinated hydrocarbons analyzed	
U086	Hexachlorobenzene	Samples 105,108 - low
	α-BHC	Samples 105,108 - low
	Mirex	Samples 105,108 - low
	p,p'-DDE	Sample 105 - low
	p,p'-DDD	Samples 105,108 - v.low
	p,p'-DDT	Sample 105 - low
	1,4-DCB, 1,3-DCB,1,2-DCB, 1,3,5-TCB, 1,2,4-TCB, 1,2,3-TCB, 1,2,4,5-TeCB, 1,2,3,4-TeCB, PeCB, HCB And Hexachlorobutadiene	Samples 109,112,110,111 - low
	Octachlorostyrene	Samples 109,112 - low

APPENDIX I

Glossary of Terms

(1) Ranking

Ranking is a non-parametric statistical technique used for the detection of pronounced systematic error (bias) in interlaboratory studies. According to Youden's procedure, rank 1 is given to the laboratory that provided the lowest result, rank 2 to the next lowest. In case of a tie, the average rank is given to the tied laboratories. Results with a < sign are not ranked. For each parameter, the total rank of each laboratory is the sum of individual ranks on each sample. In the case of six test samples and ten laboratories, the 5% probability limits for ranking scores are 14 and 52. A laboratory with a score lower than 14 is identified as biased low. Similarly, a laboratory with a total rank higher than 52 is biased high. In both cases, their results are classified as outliers. In cases where a laboratory did not provide all the results, or some of the results were not ranked, the average rank instead of total rank was used for the determination of biased statements.

The more comparable, i.e. better, laboratories should have ranks in the middle rather than at the extreme ends. However, laboratories with middle ranks do not necessarily mean that they provide more consistent results since very high results (high ranks) and very low

results (low ranks) would average out to yield a total rank close to the median. Therefore, ranking alone is not sufficient to determine the performance of a laboratory.

(2) Flagging

When the true values of constituents in test samples are unknown, individual results can be evaluated in terms of their absolute differences from the interlaboratory medians. Medians are chosen rather than means since they are not influenced by a moderate number of extreme values. By this flagging technique, all results are graded into the following three groups in the order of decreasing accuracy: (1) results with no flags, (2) results with H or L flags, and (3) results with VH or VL flags. Before evaluation is performed, three parameters, namely, Lower Limit for use of Basic Acceptable Error (LLBAE), Basic Acceptable Error (BAE), and Concentration Error Increment (CEI) are to be set. LLBAE is usually set at the lower end of the medians in the test samples. According to our previous interlaboratory studies on PCBs, a 30% error at LLBAE is considered reasonable and thus this is used as BAE. For samples whose medians are at or below LLBAE, the results are evaluated according to the following formulae:

	Absolute difference between sample and median results	$\leq$ BAE	:	acceptable
BAE <	Absolute diffence between sample and median results	$\leq$ 1.5 x BAE	:	H or L
	Absolute difference between sample and median results	> 1.5 x BAE	:	VH or VL

For samples whose medians are above the LLBAE, the allowable BAE is augmented by adding an increment to the BAE. This increment is calculated by multiplying the CEI by the difference between the sample median and LLBAE values. In this study, CEI is set at 0.2. Sample results are again evaluated by the above three formulate except that the augmented BAE is used instead of BAE.

For futher discussion on this evaluation technique, please refer to the original paper by Clark.

Codes

NA:	not analyzed
NRA:	not routinely analyzed
N or ND:	not detected
NAPP:	not applicable

Bias: A set of results is said to biased when the set exhibits a tendency to be either higher or lower than some standard - the standard which has been used in the analysis of our studies thus far has been the performance of all other participating laboratories. The ranking procedure employed in testing for bias is described in W.J. Youden's paper, "Ranking Laboratories by Round-Robin Tests from Precision Measurement and Calibration, H.H. Ku, Editor, NBS Special Publication 300 - Volume 1, U.S. Government Printing Office, Washington, D.C., 1969. In this paper, Youden establishes the rationale for evaluating laboratories' performance by ranking results. In our use of the procedure there is about 1 chance in 20 of deeming a set of results biased when in fact it is not, that is, $\alpha = 0.05$.

W: A "W" code is used with a reported result when no measurement was possible due to no response of the instrument to the sample. The "W" is preceded by the smallest determinative division that can be used in the units used in reporting.

T: The "T" code is used with values between the Criterion of Detection and the "W" value. The Criterion of Detection is commonly thought of by many as the limit of detection.

APPENDIX II

UGLCC INTERLABORATORY PERFORMANCE EVALUATION STUDY

QM-1 PCBs, OCs and CHs in AMPULES

FINAL DATA SUMMARY

UPPER GREAT LAKES CONNECTING CHANNELS

QM-1: PCBs IN AMPULES
Part I

FINAL DATA SUMMARY

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: TOTAL PCB PG/UL

SAMPLE RESULTS

LAB	101	102	103	104
U001	1430.	197.	1450.	189.
U005	2010.	187.	2130.	200.
U009	1900.	220.	1760.	220.
U014	2030.	235.	1870.	234.
U063	1256.	172.	1265.	179.
U072	1600.	214.	1510.	214.
U075	1171.	156.	1340.	159.
U079	1550.	190.	1490.	201.
U086	1290.	150.	1280.	170.
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	9	9	9
MEAN	1581.88889	191.22222	1565.22222	196.22222
STD DEV	329.75841	28.77837	294.40354	24.41197
MEDIAN	1550.00000	190.00000	1490.00000	200.00000

UPPER GREAT LAKES CONNECTING CHANNELS

QM-1: ORGANOCHLORINE PESTICIDES IN AMPULES
Part II

FINAL DATA SUMMARY

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: HCB PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	39.5	N	N	40.0
U005	25.	N	N	26.
U009	35.6			38.6
U014	50.			50.
U063	37.4			68.3
U072	44.2			41.1
U075	44.	N	N	28.
U079	47.5	N	N	53.6
U086	28.	N	N	31.
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	0	0	9
MEAN	39.02222	0.00000	0.00000	41.84444
STD DEV	8.49011	0.00000	0.00000	13.59872
MEDIAN	39.50000	0.00000	0.00000	40.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: ALPHA-BHC PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	25.7	N	N	22.1
U009	23.6			24.4
U063	123.			21.9
U072	22.1			23.7
U086	17.	N	N	19.
TOTAL LABS REPORTING	5	5	5	5
TOTAL LABS USED	5	0	0	5
MEAN	42.28000	0.00000	0.00000	22.22000
STD DEV	45.23789	0.00000	0.00000	2.08734
MEDIAN	23.60000	0.00000	0.00000	22.10000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: GAMMA-BHC PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	24.1	N	N	20.7
U005	20.	N	N	21.
U009	24.4			24.4
U014	25.			25.
U063	30.7			21.1
U072	22.8			21.6
U079	25.9	N	N	26.1
U086	19.	N	N	19.
TOTAL LABS REPORTING	8	8	8	8
TOTAL LABS USED	8	0	0	8
MEAN	23.98750	0.00000	0.00000	22.36250
STD DEV	3.62745	0.00000	0.00000	2.48362
MEDIAN	24.25000	0.00000	0.00000	21.35000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/03/15.

PARAMETER: MIREX PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	42.9	N	N	40.8
U005	48.	N	N	48.
U009	52.			52.
U014	75.			75.
U063	231.			41.0
U072	49.3			50.0
U086	36.	N	N	35.
TOTAL LABS REPORTING	7	7	7	7
TOTAL LABS USED	7	0	0	7
MEAN	76.31429	0.00000	0.00000	48.82857
STD DEV	69.27458	0.00000	0.00000	13.00022
MEDIAN	49.30000	0.00000	0.00000	48.00000

ANALYSIS OF TOTAL PCB's , OC's AND CH's

PRINTOUT PREPARED: 86/09/15.

PARAMETER: P,P'-DDE PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	98.4	N	N	92.2
U005	91.	N	N	94.
U009	89.8			90.8
U014	100.			103.
U063	97.6			81.9
U072	100.9			101.2
U079	105.	N	N	105.
U086	75.	N	N	95.
TOTAL LABS REPORTING	8	8	8	8
TOTAL LABS USED	8	0	0	8
MEAN	94.71250	0.00000	0.00000	95.38750
STD DEV	9.41510	0.00000	0.00000	7.55294
MEDIAN	98.00000	0.00000	0.00000	94.50000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: P,P -DDD PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	40.4	N	N	36.2
U005	27.	N	N	27.
U009	50.			51.
U014	54.			55.
U063	45.8			35.9
U072	43.1			44.7
U086	16.	N	N	19.
TOTAL LABS REPORTING	7	7	7	7
TOTAL LABS USED	7	0	0	7
MEAN	39.47143	0.00000	0.00000	38.40000
STD DEV	13.43164	0.00000	0.00000	12.85444
MEDIAN	43.10000	0.00000	0.00000	36.20000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: P,P'-DDT PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	46.7	N	N	44.0
U005	41.	N	N	41.
U009	52.			51.
U014	52.			52.
U063	52.1			30.6
U072	44.9			44.6
U079	38.5	N	N	42.9
U086	36.	N	N	44.
TOTAL LABS REPORTING	8	8	8	8
TOTAL LABS USED	8	0	0	8
MEAN	45.40000	0.00000	0.00000	43.76250
STD DEV	6.42851	0.00000	0.00000	6.57570
MEDIAN	45.80000	0.00000	0.00000	44.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: HEPTACHLOR EPOXIDE PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	N	41.7	41.3	N
U005	N	33.	34.	N
U009		25.8	24.8	
U014		60.	64.	
U063		273.	37.7	
U072		40.4	39.3	
TOTAL LABS REPORTING	6	6	6	6
TOTAL LABS USED	0	6	6	0
MEAN	0.00000	78.98333	40.18333	0.00000
STD DEV	0.00000	95.73347	13.04077	0.00000
MEDIAN	0.00000	41.05000	39.50000	0.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs:

PRINTOUT PREPARED: 86/03/15.

PARAMETER: DIELDRIN PG/UL

SAMPLE RESULTS

LAB		105	106	107		108
U001	N		40.9	38.5	N	
U005	N		32.	34.	N	
U009			39.4	38.8		
U014			43.	43.		
U063			921.	39.2		
U072			42.9	43.0		
TOTAL LABS REPORTING		6	6	6		6
TOTAL LABS USED		0	6	6		0
MEAN		0.00000	186.53333	39.41667		0.00000
STD DEV		0.00000	359.83648	3.35524		0.00000
MEDIAN		0.00000	41.90000	39.00000		0.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: ALPHA-CHLORDANE PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	N	46.2	46.0	N
U005	N	52.	55.	N
U009		54.0	55.8	
U014		55.	55.	
U063		156.	53.2	
U072		53.1	52.6	
TOTAL LABS REPORTING	6	6	6	6
TOTAL LABS USED	0	6	6	0
MEAN	0.00000	69.38333	53.93333	0.00000
STD DEV	0.00000	42.54590	4.43200	0.00000
MEDIAN	0.00000	53.55000	55.00000	0.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: GAMMA-CHLORDANE PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U001	N	38.3	37.3	N
U005	N	38.	39.	N
U009		47.4	49.0	
U014		52.	52.	
U063		60.7	50.7	
U072		50.0	49.4	
U086	N	42.	41.	N
TOTAL LABS REPORTING	7	7	7	7
TOTAL LABS USED	0	7	7	0
MEAN	0.00000	46.91429	45.48571	0.00000
STD DEV	0.00000	8.20049	6.14395	0.00000
MEDIAN	0.00000	47.40000	49.00000	0.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: OXYCHLORDANE PG/UL

SAMPLE RESULTS

LAB	105	106	107	108
U005	N	23.	24.	N
U009		36.8	35.4	
U063		28.6	25.6	
U072		25.3	24.5	
TOTAL LABS REPORTING	4	4	4	4
TOTAL LABS USED	0	4	4	0
MEAN	0.00000	28.42500	27.62500	0.00000
STD DEV	0.00000	6.03787	5.30432	0.00000
MEDIAN	0.00000	26.95000	25.55000	0.00000

UPPER GREAT LAKES CONNECTING CHANNELS

QM-1: CHLORINATED HYDROCARBONS IN AMPULES
Part III

FINAL DATA SUMMARY

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/03/15.

PARAMETER: 1,4-DICHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U001	954.	146.	143.	978.
U005	840.	T 120.	T 110.	640.
U014	1200.	200.	190.	1200.
U063	962.	122.	121.	
U072	1030.	165.	160.	1200.
U086	620.	110.	110.	570.
TOTAL LABS REPORTING	6	6	6	6
TOTAL LABS USED	6	5	5	5
MEAN	934.33333	148.60000	144.80000	917.60000
STD DEV	194.20985	35.76031	31.83666	300.43102
MEDIAN	958.00000	146.00000	143.00000	978.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: 1,3-DICHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U001	881.	134.	131.	903.
U005	740.	T 100.	T 130.	600.
U014	1100.	190.	170.	1100.
U063	1137.	94.3	91.5	
U072	900.	145.	140.	1000.
U086	550.	92.	92.	570.
TOTAL LABS REPORTING	6	6	6	6
TOTAL LABS USED	6	5	5	5
MEAN	884.66667	131.06000	124.92000	834.60000
STD DEV	220.55355	40.47799	33.50570	238.49696
MEDIAN	890.50000	134.00000	131.00000	903.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: 1,2-DICHLORCBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U001	933.	142.	139.	957.
U005	810.	T 110.	T 120.	710.
U014	1200.	190.	190.	1300.
U063	1529.	165.	150.	
U072	1070.	155.	155.	1200.
U086	610.	110.	110.	640.
TOTAL LABS REPORTING	6	6	6	6
TOTAL LABS USED	6	5	5	5
MEAN	1025.33333	152.40000	145.80000	961.40000
STD DEV	320.49316	29.51779	28.89118	290.73149
MEDIAN	1001.50000	155.00000	150.00000	957.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: 1,3,5-TRICHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U001	152.	23.7	23.5	155.
U009	53.7	10.3	3.4	48.9
U063	296.	28.9	25.5	
U072	225.	32.5	35.5	260.
U086	130.	22.	22.	130.
TOTAL LABS REPORTING	5	5	5	5
TOTAL LABS USED	5	5	5	4
MEAN	171.34000	23.48000	23.78000	148.47500
STD DEV	92.65758	8.46593	9.61338	87.05728
MEDIAN	152.00000	23.70000	23.50000	142.50000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: 1,2,4-TRICHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109		110		111		112	
U001	142.		22.5		22.3		146.	
U005	250.	T		N		N		N
U009	94.2		15.9		13.9		83.7	
U014	230.		30.		30.		230.	
U063	261.		25.6		25.0			
U072	225.		34.5		34.5		255.	
U086	110.		20.		13.		120.	
TOTAL LABS REPORTING	7		7		7		7	
TOTAL LABS USED	6		6		6		5	
MEAN	177.03333		24.75000		24.11667		166.94000	
STD DEV	70.34036		6.77193		7.44404		72.37580	
MEDIAN	183.50000		24.05000		23.65000		146.00000	

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: 1,2,3-TRICHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U001	155.	24.4	24.1	158.
U009	127.1	21.9	18.4	113.9
U063	223.	25.7	24.3	
U072	230.	33.0	34.5	240.
U086	130.	20.	20.	130.
TOTAL LABS REPORTING	5	5	5	5
TOTAL LABS USED	5	5	5	4
MEAN	173.02000	25.00000	24.26000	160.47500
STD DEV	50.07197	4.98648	6.27240	56.06041
MEDIAN	155.00000	24.40000	24.10000	144.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: 1,2,4,5-TETRACHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U009	46.3	5.8	5.1	39.1
U063	49.5	7.00	7.08	
U072	100.	15.0	15.0	110.
U086	61.	10.	11.	62.
TOTAL LABS REPORTING	4	4	4	4
TOTAL LABS USED	4	4	4	3
MEAN	64.20000	9.45000	9.54500	70.36667
STD DEV	24.68724	4.10000	4.38590	36.18291
MEDIAN	55.25000	8.50000	9.04000	62.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: 1,2,3,4-TETRACHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U001	67.4	11.1	11.0	69.4
U009	70.1	12.8	11.3	65.5
U063	115.	10.3	10.0	
U072	110.	15.5	16.0	120.
U086	57.	9.3	9.5	58.
TOTAL LABS REPORTING	5	5	5	5
TOTAL LABS USED	5	5	5	4
MEAN	83.90000	11.80000	11.56000	78.22500
STD DEV	26.62104	2.43311	2.58708	28.24894
MEDIAN	70.10000	11.10000	11.00000	67.45000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: PENTACHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U001	73.0	12.2	12.1	76.8
U009	81.3	12.6	10.9	72.0
U063	*17281.*	1589.	1520.	
U072	105.	15.5	15.5	115.
U066	61.	9.6	9.8	61.
TOTAL LABS REPORTING	5	5	5	5
TOTAL LABS USED	4	5	5	4
MEAN	80.07500	327.78000	313.66000	81.20000
STD DEV	18.58913	705.04652	674.36795	23.48390
MEDIAN	77.15000	12.60000	12.10000	74.40000

* NOT USED IN THE CALCULATION OF THE MEAN.*

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: HEXACHLOROBENZENE PG/UL

SAMPLE RESULTS

LAB		109		110		111		112
U001		44.6		7.34		7.30		45.0
U005	N		N		N		N	
U009		37.5		7.2		5.9		34.0
U014		50.		10.		10.		60.
U063		42.3		3.46		3.24		
U072		47.5		7.5		7.5		50.5
U075		46.		6.5		6.7		45.
U086		31.		5.2		5.4		31.
TOTAL LABS REPORTING		8		8		8		8
TOTAL LABS USED		7		7		7		6
MEAN		42.70000		6.74286		6.57714		44.25000
STD DEV		6.51818		2.03979		2.08510		10.66654
MEDIAN		44.60000		7.20000		6.70000		45.00000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: HEXACHLOROETHANE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U005	N	N	N	N
U009	37.3	4.9	4.5	32.5
U014	40.	10.	10.	50.
U072	38.5	6.0	5.0	41.5
U086	37.	5.0	5.0	38.
TOTAL LABS REPORTING	5	5	5	5
TOTAL LABS USED	4	4	4	4
MEAN	38.20000	6.47500	6.37500	40.50000
STD DEV	1.36382	2.40191	2.49583	7.33712
MEDIAN	37.90000	5.50000	5.50000	39.75000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: HEXACHLOROBUTADIENE PG/UL

SAMPLE RESULTS

LAB	109		110		111		112	
U005	N		N		N		N	
U009		45.2		6.7		6.1		40.1
U014		70.		10.		10.		70.
U072		48.0		7.5		7.5		53.5
U086		32.		5.0		4.9		33.
TOTAL LABS REPORTING		5		5		5		5
TOTAL LABS USED		4		4		4		4
MEAN		48.80000		7.30000		7.12500		49.15000
STD DEV		15.76156		2.08006		2.19146		16.29284
MEDIAN		46.60000		7.10000		6.80000		46.80000

ANALYSIS OF TOTAL PCBs , OCs AND CHs

PRINTOUT PREPARED: 86/09/15.

PARAMETER: OCTACHLOROSTYRENE PG/UL

SAMPLE RESULTS

LAB	109	110	111	112
U009	72.5	13.6	11.0	64.1
U072	98.5	15.5	15.0	105.
U075	104.	13.9	13.7	105.
U086	73.	12.	12.	74.
TOTAL LABS REPORTING	4	4	4	4
TOTAL LABS USED	4	4	4	4
MEAN	87.00000	13.75000	12.92500	87.02500
STD DEV	16.60823	1.43411	1.77647	21.14559
MEDIAN	85.75000	13.75000	12.85000	89.50000

APPENDIX III

Changes submitted on August 6, 1986 by Laboratory U063

UGLCC INTERLABORATORY STUDY
QM-1 ORGANOCHLORINE & CHLORINATED HYDROCARBON RESULTS (pg/uL)

Sample 112

1,3 Dichlorobenzene	1217
1,4 Dichlorobenzene	747
1,2 Dichlorobenzene	1878
1,3,5 Trichlorobenzene	344
1,2,4 Trichlorobenzene	283
1,2,3 Trichlorobenzene	264
1,2,4,5 Tetrachlorobenzene	42.8
1,2,3,4 Tetrachlorobenzene	140
Pentachlorobenzene	133
Hexachlorobenzene	47.6

Sample 109

Pentachlorobenzene	110

Sample 110

Pentachlorobenzene	10.1

Sample 111

Pentachlorobenzene	9.64

Sample 105

α-BHC	27.3
Mirex	47.6
p,p'-DDT	41.5

Sample 106

Heptachlor epoxide	43.6
Dieldrin	42.1
α-Chlordane	72.5
γ-Chlordane	58.8