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UPPER GREAT LAKES CONNECTING CHANNELS INTERLABORATORY PERFORMANCE EVALUATION STUDY QM-8: ORGANOCHLORINES IN AMPULES AND WATER FINAL REPORT

by
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Research and Applications Branch
National Water Research Institute
Canada Centre for Inland Waters
Burlington, Ontario, Canada

and the Quality Management Work Group

October 1987

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and

The Quality Management Work Group

sent to the QMWG for review and approval

MANAGEMENT PERSPECTIVE

The Upper Great Lakes Connecting Channels (UGLCC) have been designated as "Areas of Concern" by the International Joint Commission. A Canada - U.S. bi-national 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, which are contributing data to the UGLCC study, to generate reliable and accurate data during the study, a Quality Management Work Group was formed and 13 interlaboratory performance evaluation studies were implemented.

This report summarizes and evaluates the results from the eighth interlaboratory performance evaluation study, QM-8 which consisted of the analysis of twelve organochlorines in ampules and water. Results were received from ten out of 15 participating laboratories (six Canadian, four U.S.). With the exception of one laboratory, most of the data received for the standard solutions were satisfactory and comparable. Similarly, data for the water samples, although a little more erratic, were also satisfactory and comparable with the exception of one or two laboratories. All laboratories have been provided with the appropriate feed-back.

Dr. J. Lawrence
Director
Research and Applications Branch

PERSPECTIVE - GESTION

Les chenaux reliant la Grands Lacs d'amont (CRGLA) ont été désignés comme des "secteurs préoccupants" par la Commission mixte internationale. Une étude binationale Canada - États-Unis portant sur l'identification et l'évaluation des impacts environnementaux des substances toxiques dans ces zones a été entreprise en 1984. Un Groupe de travail sur la gestion de la qualité a été mis sur pied et 13 études interlaboratoires d'évaluation de la performance ont été faites afin d'aider les laboratoires analytiques qui fournissent des données pour l'étude CRGLA.

Le présent document décrit les résultats de la huitième étude interlaboratoire d'évaluation de la performance, QM-8, qui consistait à analyser douze composés organochlorés dans des ampoules et dans l'eau. Des quinze participants originaux, dix laboratoires (six du Canada et quatre des États-Unis) ont fait parvenir leurs résultats. À l'exception d'un laboratoire, la plupart des données reçues pour les solutions étalons étaient satisfaisantes et comparables. Bien que plus erratiques, les données sur les échantillons d'eau étaient également satisfaisantes et comparables, à l'exception d'un ou deux laboratoires. Tous les laboratoires participants ont reçu une rétroaction appropriée.

J. Lawrence
Directeur, Direction générale de la recherche et des applications

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, thirteen interlaboratory performance evaluation studies were designed and conducted by the Quality Management Work Group.

This report describes the results from the eighth interlaboratory performance evaluation study, QM-8, which consisted of the analysis of organochlorines in ampules and water. Results were received from 10 out of 15 participating laboratories (six Canadian, four U.S.).

The results from the standard solutions were for the most part accurate and precise. Data for the water samples were not as precise as the standard solutions and accuracy was more erratic. With the elimination of outlying data from one or two laboratories the results received from this study were accurate and comparable in relation to the design values. All laboratories that participated had detection limits and methodologies suitable for the analysis of organochlorines in natural water.

RESUME

L'étude des chenaux reliant les Grands Lacs d'amont (CRGLA) reconnaît que les aspects assurance de la qualité/contrôle de la qualité (AQ/CQ) sont des éléments vitaux pour l'utilité globale des résultats de l'étude. Dans le cadre du programme AQ/CQ, treize études interlaboratoires ont été conçues et faites par le Groupe de travail sur la gestion de la qualité.

Le présent document décrit les résultats de la huitième étude interlaboratoire d'évaluation de la performance, QM-8, qui consistait à analyser les composés organochlorés dans des ampoules et dans l'eau. Dix des quinze laboratoires participants ont présenté leurs résultats (six du Canada et quatre des Etats-Unis).

Dans le cas des solutions étalons, la plupart des résultats étaient précis. Les données sur les échantillons d'eau n'étaient pas aussi précis, et elles étaient plus erratiques. Après élimination des données trop éloignées de la moyenne provenant d'un ou deux laboratoires, les résultats reçus dans le cadre de cette étude étaient précis et comparables aux valeurs nominales. Tous les laboratoires participants avaient des limites de détection et des méthodes appropriées pour l'analyse des composés organochlorés présents dans l'eau naturelle.

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, bi-national study was initiated 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 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, thirteen interlaboratory performance evaluation (QC) studies were designed and conducted by the Quality Management Work Group. The goal of these QC studies is to assist analytical laboratories, which 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 eighth interlaboratory study, QM-8, was initiated on February 28, 1986. It involved the analysis of twelve organochlorines (OC's) in ampules and water. The original deadline for reporting results was set for May 15, 1986. However, since several laboratories were late in reporting, the study was not closed until September 30, 1986.

STUDY PROFILE

From the returned questionnaires, the following 15 laboratories confirmed their participation in this study: U001, U013, U014, U063, U072, U077, U086, U091, U092, U093, U049, U057, U075, U078, and U090. By the time the study was closed (September 30, 1986) the last

five laboratories had not submitted any results. See list of participants at the end of this report.

Since erratic in-house standards have been shown to be major sources of error in previous interlaboratory studies for organic parameters, the first part of this study was designed to determine the accuracy of the participants' calibration standards for organochlorine analysis. Fortified water samples were also provided to the participants for the evaluation of their overall performance in OC analysis.

Each laboratory was provided with eight ampules and two one litre samples of naturally occurring surface water. Four of the ampules were to be analyzed by direct injection, two of the ampules were to be used to spike the two water samples provided and the remaining two ampules were to be used to spike two samples of the laboratory's own organic-free water.

The four spiked water samples were to be extracted and analyzed alongside the four ampule samples analyzed for OC's according to each laboratory's in-house procedures. The 12 OC's were hexachlorobenzene (HCB), α-BHC, γ-BHC, Mirex, p,p'-DDE, p,p'-DDD, p,p'-DDT, heptachlor epoxide, dieldrin, α-chlordane, γ-chlordane and oxychlordane.

All standard solutions and test samples were prepared by the Quality Assurance Project Team, Research and Applications Branch of the National Water Research Institute (NWRI). Stock solutions of the individual OC's were prepared gravimetrically from primary grade standards of purity greater than 98%. Working solutions were prepared by combining dilutions of the individual stock solutions. The design values as well as the interlaboratory median for each OC in test samples 801 through 808 are presented in Table 2. The design values were checked against in-house quality control samples from other QC studies by two analysts on different dates.

Ampules 801 - 804 were identical to those which were used in study QM-1(ampules 105-108) and were also used in IJC Interlaboratory Study 52 which involved more than 20 laboratories. The interlaboratory

medians of the parameters for these samples from all three studies were within 10% and confirmed the design value.

In order to provide some indication of analytical precision, the samples were sent out in blind duplicate pairs as outlined in Table 1.

RESULTS AND DISCUSSION

Analytical Methodology

In this study, all standard solutions in ampules 801 - 804 were quantified by direct injection into a gas chromatograph using an electron-capture detector and a suitable column. Water samples prepared from ampules 805 - 808 were analyzed similarly after appropriate extraction cleanup and solvent replacement. Of the nine laboratories submitting results for water samples (one laboratory did not analyze the water samples), eight used dichloromethane (DCM) and one used hexane extraction procedures. Five of the participants used Snyder columns and Kuderna-Danish evaporators for evaporative concentration of the extract while four used rotary evaporators. Five laboratories used Florisil cleanup, two used silica gel, one used alumina and one used gel permeation chromatography.

Three of the laboratories injected the cleaned extract directly while six fractionated the OC's into two or three fractions during cleanup using solvents of increasing polarity (i.e. a combination of hexane, benzene, diethyl ether in hexane, diethyl ether in petroleum, ether, dichloromethane in hexane and/or diethyl ether in dichloromethane). Three laboratories used a single GC column for analysis, five used dual columns and two used triple columns. One laboratory used a combination of packed and fused silica capillary columns for analysis while two used packed columns exclusively and seven used capillary columns exclusively. All ten participants used electron capture for detection . See Table 3 for details of methodologies.

Data Evaluation

All raw data submitted by the participants are listed by parameter in the data summary (Appendix II).

In order to evaluate the precision and accuracy of the OC results in this study, the percent recoveries (reported vs design values and reported vs interlaboratory medians) were calculated (Table 4).

To provide a semi-quantitative evaluation of the results, the recoveries were designated as very low, low, satisfactory, high or very high as follows:

% Recovery	Designation
$\geq$ 150	Very high
149 - 125	High
124 - 76	Satisfactory
75 - 51	Low
$\leq$ 50	Very low

See Table 5 for a summary of each laboratory's results.

General Comments

Only one of the ten reporting laboratories submitted their data by the originally set deadline (U014).

Computer printouts of the raw data were sent out to all reporting laboratories for verification in October 1986. All laboratories returned their results verified with no changes. A final data summary was sent out to the participating laboratories, the Quality Management Work Group, the work group chairmen and the MC and AIC chairmen on November 20, 1986.

Five out of ten reporting laboratories submitted results for all twelve parameters on all eight samples while three laboratories were missing one to four parameters. Two laboratories did not analyze all the samples. Laboratory U091 did not analyze any of the water samples and laboratory U013 did not analyze the water samples which were to have been prepared using its own organic-free water nor did it complete the analysis of the remaining samples.

The interlaboratory medians for ampules 801 - 804 were in good agreement with the design values. Most medians were between 90 and 100% recovery except for HCB, Mirex, p,p'-DDD and p,p'-DDT (84, 88, 89 and 82%, respectively). The means were all over-recovered due mainly to the very high results of one laboratory (U063). Only means for p,p'-DDE and p,p'-DDT were within ±10% of the design value, while the other parameters ranged from 112 to 139% recovery. The interlaboratory medians for water samples 805 - 808 were in reasonable agreement with the design values. Most medians were between 80 and 110% recovery except for HCB (77% for ampules 805 - 806 and 62% for 807 - 808) and α-BHC (70% for 807 - 808). Approximately two-thirds of the means were over-recovered, again due mainly to the high results of one laboratory (U063). The means ranged from 56 to 137% recovery of the design values. Because of the limited number of participants, addition or deletion of data sets can significantly change the means and even the medians. After rejection of obvious outlying data there is a significant improvement in the precision of the interlaboratory data. The means and the medians were within ±10% of the design value and the relative standard deviations were better than 15% in most cases

indicating that both the comparability and accuracy of these interlab data were satisfactory.

The interlaboratory median results for ampules 801 - 804 from this study compare very favourably with the medians from study QM-1 (ampules 105 - 108). All of the medians are within ±10% of each other and half are within ±5%.

All of the data submitted were useful for the purposes of evaluation since none of the laboratories reported any results as "less than". The design values were all above each lab's detection limit although limits for laboratory U014 came close. Detection limits ranged from 0.01 to 10 pg/uL for the ampules and 0.01 to 10 ng/L for the water samples. The methodologies employed for organochlorines by the laboratories all may be considered suitable for the monitoring of such compounds in natural water samples.

Lab Specific Comments

U001

This laboratory reported results for all parameters except oxychlordane which was not routinely analyzed. Precision for duplicate pairs of ampules (801 - 802 and 803 - 804) was better than ±12% with the exception of p,p'-DDD (±21%) while for duplicate pairs of spiked water samples (805 - 806 and 807 - 808) precision was a little worse. Most of the results were within ±15% except for α-BHC (±16% for 805-806), p,p'-DDD (±18% for 805-806), p,p'-DDT (±16% for 805-806) and dieldrin (±19% for807-808). Based on the design value, accuracy (accuracy for ampules 801 - 804) was very good, ranging from 65 to 122%. Out of 22 results reported, all were satisfactory except for one low result. Accuracy for the spiked water samples ranged from 58 to 129%. 37 out of 44 results were satisfactory while six recoveries were low and one was high.

U013

This laboratory submitted partial results just after the second deadline. Water samples 807 and 808 were not analyzed at all, heptachlor epoxide and dieldrin were not determined on water samples 805 and 806 and Mirex was not reported for any sample. Precision of duplicate pairs was within ±7% for the ampules with one exception for p,p'-DDE (±12%). Precision for the water samples was worse. Most duplicate results were within ±16% except for a few erratic values for HCB (±114%), α-BHC (±65%), γ-BHC (±30%) and γ-chlordane (±28%). Accuracy for the ampules was very good. Out of 22 results reported, 20 recoveries were satisfactory and two were low with a range of 65 to 122%. For the water samples, accuracy was poor (range 7 - 86%) since only three recoveries out of 18 results reported were satisfactory. Two recoveries were very low and thirteen were low.

U014

Results for all parameters were submitted by this laboratory except for α-BHC and oxychlordane which are not routinely analyzed. Precision of duplicate pairs of ampules was very good. Most results were within ±7%. For the spiked waters, duplicate pair precision was as good (±10%) with the exception of dieldrin (±17% for 807-808). Accuracy for the ampules was average, having a range of 71 - 175% recovery of the design value. Of 20 results reported, 14 were satisfactory, while two results were very high, three were high and one was low. Accuracy for the water samples was a little better than the ampules (range 62 - 149%) since a higher percentage of results were satisfactory. Of 40 results reported, 30 were satisfactory, six were low and four were high.

U063

This laboratory submitted results for all parameters requested. Although precision for duplicate pairs of ampules was within ±8%, it was erratic for the spiked water duplicates ranging from ±2% for p,p'-DDT (807-808) to ±134% for α-BHC (807-808). Accuracy was a problem for this laboratory for all the samples. All 24 results for the ampules were very high (range 250 - 566% recovery) and of 48 results reported for the water samples 37 were very high, three were high, five were very low and only three were satisfactory (range 1 - 426% recovery).

These results strongly suggested that the in-house OC standard solutions of lab U063 were highly inaccurate and biased high. The fact that the overall recovery of OC in the water samples were notably lower than those obtained for the ampule samples indicated that their extraction recovery was very low.

U072

Results were submitted by this laboratory for all parameters requested. Precision for duplicate pairs of ampules was excellent (±4%). The water samples had a precision that was not as good (±15% for most results) with HCB (±25% for 807-808), α-BHC (±23% for 807-808) and p,p'-DDE (±16% for 807-808) being worse. Accuracy was also excellent for the ampules since all 24 results reported were designated as satisfactory. In fact, the worst recovery was still better than 85% of the design value. The accuracy of water sample results was quite good as only eight recoveries were unsatisfactory out of 48 results (range 59 - 166%). One result was very low, three were low, two were high and two were very high.

U077

This laboratory submitted results for all the parameters requested. Precision for the ampules was excellent (±2%) except for p,p'-DDT (±12%). Precision was a little erratic for the water samples, since about half the results were within ±5% while the rest ranged up to ±34% (p,p'-DDT). Accuracy was very good for the ampules with a range of 73 - 122% recovery. Out of 24 results reported, 23 were satisfactory while one recovery was low. Accuracy for the water samples was average as only 27 recoveries out of 48 results were satisfactory while 19 were low, one was very low and one was high (range 49 - 128%).

U086

Heptachlor epoxide, dieldrin, α-chlordane and oxychlordane were the only parameters not reported by this laboratory. The precision of duplicate pairs of ampules was within ±10%. Precision for the water samples was very erratic for α- and γ-BHC and also erratic for p,p'-DDT. Accuracy was satisfactory for 14 out of 16 results reported for the ampules (range of 70 - 100%) while two recoveries were low. For the water samples, out of 32 results reported, 17 recoveries were satisfactory, while five were very low, nine were low and one was high (range 8 - 129%).

U091

This laboratory submitted results only for ampules 801 - 804 and did not analyze any of the water samples. Precision for the duplicate pairs of ampules was excellent (±3%). Accuracy also was excellent ranging from 87 to 109% recovery with one exception: HCB had a very low recovery of 21% which appears to be the result of a bad standard. Out of 24 results, 22 were designated satisfactory.

U092

Results were submitted by this laboratory for all parameters requested. Precision for the duplicate pairs of ampules was excellent (±2%) while for the water samples it was much worse. Precision was generally within ±12% except for α-BHC (±43% for 807-808) and γ-BHC (±23% for 807-808). Accuracy was good for the ampules. Out of 24 results reported 20 were satisfactory with a range of 46 - 95% recovery. Two results were very low and two were low. Accuracy for the water samples was average ranging from 49 to 108% recovery. Only 32 results of 48 reports were satisfactory, while 15 recoveries were low and one was very low.

U093

This laboratory submitted results for all parameters requested. Precision for duplicate pairs of ampules was excellent (±3%). The precision for the water samples was erratic with at least one imprecise result for α-BHC, γ-BHC, p,p'-DDE, p,p'-DDD, p,p'-DDT and oxychlordane. Accuracy was satisfactory for 19 of 24 results reported, five recoveries being low (range 52 - 93%). For the water samples accuracy was below average since just over half (27) of the 48 results reported were satisfactory. Four recoveries were very low, two were low, seven were high and eight were very high (range 37 - 194%)

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LIST OF PARTICIPANTS

Michigan Department of Natural Resources, Lansing, Michigan.
Michigan Department of Public Health, Lansing, Michigan.
National Water Quality Laboratory, Burlington, Ontario.
National Water Research Institute - Environmental Contaminants Division - Organics Properties Section, Burlington, Ontario.
Ontario Ministry of the Environment (Trace Organic Section), Rexdale, Ontario
Ontario Ministry of the Environment (Waste Water Section), Rexdale, Ontario.
Ontario Ministry of the Environment, Thunder Bay, Ontario.
Raytheon Service Corporation (U.S. EPA - Large Lakes Research Station), Grosse Ile, Michigan.
U.S. Geological Survey - NWQL, Arvada, Colorado.
Zenon Environmental Inc., Burlington, Ontario.

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

Barringer Magenta Ltd., Rexdale, Ontario.
Beak Analytical Services, Mississauga, Ontario (volunteer lab).
Mann Testing Laboratories Ltd., Mississauga, Ontario.
U.S. Army Corps of Engineers, Detroit, Michigan
Wastewater Technology Centre, (Conservation and Protection, Toronto) Burlington, Ontario.

REFERENCES

1. Horn, W., Szawiola R. and Lee, H.B. Upper Great Lakes Connecting Channels Interlaboratory QA/QC Study QM-1: PCB's, OC's and CH's in ampules - Final Report. NWRI Contribution 86 -166.
2. Report of the IJC Data Quality Work Group, Windsor, Ontario, January 1986/April 1987.

TABLE 1

Samples Distributed for Study QM-8

Sample	Description
801	Mixture of seven OC's in isooctane
802	Same as 801
803	Mixture of five OC's in isooctane
804	Same as 803
805	Mixture of twelve OC's in acetone (Level 1)
806	Same as 805
807	Mixture of twelve OC's in acetone (Level 2)
808	Same as 807

TABLE 2

Design Values and Interlaboratory Medians for Organochlorines

Parameter	pg/uL Design Value	pg/uL Interlab. Median		pg/uL Design Value	pg/uL Interlab. Median	
		801	802		803	804
HCB	51.8	41.9	45.1	-	-	-
Alpha-BHC	26.2	23.9	23.4	-	-	-
Gamma-BHC	24.9	22.7	22.5	-	-	-
Mirex	54.3	47.0	48.0	-	-	-
p,p'-DDE	111.4	98.6	98.8	-	-	-
p,p'-DDD	50.4	43.0	44.0	-	-	-
p,p'-DDT	50.9	41.6	41.5	-	-	-
Heptachlor epoxide	-	-	-	39.5	38.4	39.3
Dieldrin	-	-	-	43.0	42.0	41.0
Alpha-Chlordane	-	-	-	52.6	52.0	52.0
Gamma-Chlordane	-	-	-	48.9	45.5	47.5
Oxychlordane	-	-	-	24.5	23.0	23.9

Parameter	ng/L Design Value	ng/L Interlab. Median		ng/L Design Value	ng/L Interlab. Median	
		805	806		807	808
HCB	25.9	20.0	20.0	104.0	66.6	63.0
Alpha-BHC	52.4	54.7	51.5	210.0	123.0	173.0
Gamma-BHC	24.9	21.0	22.0	99.6	78.0	87.4
Mirex	27.2	26.3	26.8	109.0	99.8	96.1
p,p'-DDE	27.8	26.0	30.0	111.0	126.0	111.0
p,p'-DDD	25.2	22.0	25.0	101.0	91.0	108.0
p,p'-DDT	25.4	19.0	22.0	102.0	77.0	98.5
Heptachlor epoxide	24.7	29.0	25.9	98.7	92.0	102.0
Dieldrin	26.9	25.9	25.2	108.0	89.9	101.0
Alpha-Chlordane	26.3	24.3	24.8	105.0	104.0	92.0
Gamma-Chlordane	24.4	21.0	22.0	97.8	89.0	86.5
Oxychlordane	24.5	20.7	21.7	98.1	86.9	76.2

TABLE 3

Analytical Methodology for Organochlorines

LAB NO.	SAMPLE PREPARATION	SEPARATION & DETECTION
U001	DCM extraction, rotovapour concentration, silica gel cleanup and fractionation (A-hexane, B-benzene), autoinjection and peak integration	30 m SPB-5, FSCC; EC
U013	DCM extraction, Snyder column concentration, gel permeation cleanup, autoinjection and auto data reduction	60 m DB-5 FSCC, EC
U014	DCM extraction, Snyder column concentration, Florisil cleanup and fractionation (A-6% diethyl ether in hexane, B-50% diethyl ether in hexane), autoinjection and auto data reduction	dual: 25 m x 0.2 mm 5% phenyl methyl silicon FSCC; EC 25 m x 0.22 mm Sil 19 CB FSCC; EC
U063	DCM extraction, rotovapour concentration, fractionation (A-hexane, B-benzene), manual injection	DB-5 FSCC; EC
U072	DCM extraction, Snyder column concentration, Florisil fractionation (A 6% diethyl ether in pet. ether, B-15% diethyl ether in pet. ether), auto data collection	triple 6ft: 3% SE30 on Gas Chrom Q, EC 1.5% OV17 + 1.95% QF1 on Gas Chrom Q; EC 4% SE 30 + 6% OV210 on Gas Chrom Q; EC

TABLE 3 - continued

Analytical Methodology for Organochlorines

LAB NO.	SAMPLE PREPARATION	SEPARATION & DETECTION
U077	Hexane, extraction, Snyder column concentration alumina cleanup, silica gel cleanup, and fractionation (A-hexane B-benzene), manual injection	dual 1.8 m x 2mm: 3% SP-2100 on Supelcoport; EC 1.5% SP-2250 + 1.95% SP-2401 on Supelcoport; EC
U086	DCM extraction, Snyder column concentration Florisil cleanup, autoinjection, auto data collection	dual 25 m x 0.2 mm: OV-1 FSCC; EC SE-54 FSCC; EC
U091	not applicable Water samples not analysed	1: 4 m x 2 mm 3% Dexsil 300 on Chromosorb W HP; EC 2: dual: 25 m x 0.2 mm methyl silicone FSCC; EC 30 m x 0.25 mm DB 1701 FSCC; EC
U092	DCM extractions, rotovapour concentration, Florisil cleanup, autoinjection, auto data system	dual 30 m x 0.25 mm: SPB-1 FSCC; EC DB-1701 FSCC; EC
U093	DCM extraction, rotovapour concentration, Florisil cleanup, fractionation (A-hexane, B-25% DCM in hexane, C-25% diethyl ether in DCM)	dual: 30 m x 0.25 mm: DB-1 FSCC; EC DB-1701 FSCC; EC

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U001

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	75.3	89.8	-	-	93.1	103	-	-
Alpha-BHC	86.3	88.5	-	-	94.6	99.1	-	-
Gamma-BHC	89.6	92.0	-	-	98.5	102	-	-
Mirex	78.8	91.7	-	-	91.1	104	-	-
p,p'-DDE	88.6	102	-	-	100	115	-	-
p,p'-DDD	64.7	87.1	-	-	75.8	99.9	-	-
p,p'-DDT	77.0	87.2	-	-	94.2	107	-	-
Heptachlor epoxide	-	-	122	117	-	-	126	117
Dieldrin	-	-	104	99.8	-	-	101	105
Alpha-Chlordane	-	-	101	98.5	-	-	102	99.6
Gamma-Chlordane	-	-	90.4	86.7	-	-	97.1	89.3
Oxychlordane	-	-	NA	NA	-	-	NA	NA

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	79.5	80.3	83.5	84.9	103	104	130	140
Alpha-BHC	114	91.0	83.8	82.4	109	92.6	143	100
Gamma-BHC	94.0	75.9	92.2	90.7	111	85.9	118	103
Mirex	82.7	89.3	86.8	88.3	85.6	90.7	94.8	100
p,p'-DDE	84.5	79.9	109	103	90.4	74.0	96.4	103
p,p'-DDD	74.6	57.9	83.3	74.0	85.4	58.4	92.5	69.5
p,p'-DDT	91.3	80.7	72.5	57.5	122	93.2	96.0	59.5
Heptachlor epoxide	121	105	129	124	103	100	138	120
Dieldrin	94.1	71.4	104	92.6	97.7	76.2	125	99.3
Alpha-Chlordane	93.5	83.7	102	93.5	101	88.7	103	107
Gamma-Chlordane	85.2	76.2	98.0	86.4	99.0	84.5	108	97.7
Oxychlordane	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U013

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	90.7	88.8	-	-	112	102	-	-
Alpha-BHC	103	103	-	-	113	115	-	-
Gamma-BHC	108	100	-	-	119	111	-	-
Mirex	NA	NA	-	-	NA	NA	-	-
p,p'-DDE	98.7	83.5	-	-	112	94.2	-	-
p,p'-DDD	75.4	79.4	-	-	88.4	91.0	-	-
p,p'-DDT	70.7	64.8	-	-	86.5	79.5	-	-
Heptachlor epoxide	-	-	96.2	96.2	-	-	99.0	96.7
Dieldrin	-	-	112	107	-	-	114	112
Alpha-Chlordane	-	-	76.0	83.6	-	-	76.9	84.6
Gamma-Chlordane	-	-	85.9	90.0	-	-	92.3	92.6
Oxychlordane	-	-	122	114	-	-	130	117

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	6.95	65.6	NA	NA	9.00	85.0	NA	NA
Alpha-BHC	26.7	72.5	"	"	25.6	73.8	"	"
Gamma-BHC	52.2	80.3	"	"	61.9	90.9	"	"
Mirex	NA	NA	"	"	NA	NA	"	"
p,p'-DDE	61.2	68.3	"	"	65.4	63.3	"	"
p,p'-DDD	63.5	79.4	"	"	72.7	80.0	"	"
p,p'-DDT	74.8	70.9	"	"	100	81.8	"	"
Heptachlor epoxide	NA	NA	"	"	NA	NA	"	"
Dieldrin	NA	NA	"	"	NA	NA	"	"
Alpha-Chlordane	64.6	68.4	"	"	70.0	72.6	"	"
Gamma-Chlordane	57.4	86.1	"	"	66.7	95.5	"	"
Oxychlordane	65.3	73.5	"	"	77.5	83.1	"	"

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U014

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	90.7	94.6	-	-	112	109	-	-
Alpha-BHC	NRA	NRA	-	-	NRA	NRA	-	-
Gamma-BHC	133	145	-	-	146	160	-	-
Mirex	92.1	93.9	-	-	106	106	-	-
p,p'-DDE	110	111	-	-	125	126	-	-
p,p'-DDD	123	125	-	-	144	143	-	-
p,p'-DDT	70.7	78.6	-	-	86.5	96.4	-	-
Heptachlor epoxide	-	-	170	175	-	-	174	176
Dieldrin	-	-	97.7	95.3	-	-	100	100
Alpha-Chlordane	-	-	110	112	-	-	112	113
Gamma-Chlordane	-	-	112	115	-	-	121	118
Oxychlordane	-	-	NRA	NRA	-	-	NRA	NRA

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	73.45	77.2	64.4	61.5	95.0	100	101	102
Alpha-BHC	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA
Gamma-BHC	84.3	92.4	83.3	96.4	100	105	106	110
Mirex	103	103	96.3	88.1	106	104	105	99.9
p,p'-DDE	101	108	97.3	97.3	108	100	86.1	97.3
p,p'-DDD	111	111	104	109	127	112	115	102
p,p'-DDT	74.8	86.6	64.7	62.7	100	100	85.8	65.0
Heptachlor epoxide	146	130	134	149	124	124	143	144
Dieldrin	112	104	93.5	119	116	111	112	127
Alpha-Chlordane	91.3	91.3	82.9	85.7	98.8	96.8	84.1	97.8
Gamma-Chlordane	86.1	90.2	81.8	90.0	100	100	89.9	102
Oxychlordane	NRA	NRA	NRA	NRA	NRA	NRA	NRA	NRA

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U063

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	542	566	-	-	671	650	-	-
Alpha-BHC	500	523	-	-	548	585	-	-
Gamma-BHC	478	482	-	-	525	533	-	-
Mirex	308	335	-	-	355	379	-	-
p,p'-DDE	254	266	-	-	287	300	-	-
p,p'-DDD	375	397	-	-	440	455	-	-
p,p'-DDT	289	305	-	-	353	373	-	-
Heptachlor epoxide	-	-	377	382	-	-	388	384
Dieldrin	-	-	316	316	-	-	324	332
Alpha-Chlordane	-	-	397	397	-	-	402	402
Gamma-Chlordane	-	-	395	397	-	-	424	408
Oxychlordane	-	-	250	258	-	-	267	264

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	113	126	5.95	1.27	146	164	9.29	2.10
Alpha-BHC	313	426	92.4	2.27	300	433	157	2.76
Gamma-BHC	290	363	202	20.9	344	410	258	23.8
Mirex	157	182	307	324	163	185	336	367
p,p'-DDE	259	299	204	195	277	277	180	195
p,p'-DDD	172	240	275	260	197	242	206	245
p,p'-DDT	88.2	126	175	180	118	145	231	187
Heptachlor epoxide	149	238	225	107	127	227	241	162
Dieldrin	244	319	5.94	209	253	341	7.13	224
Alpha-Chlordane	244	333	272	210	265	354	276	239
Gamma-Chlordane	232	329	265	224	269	365	291	253
Oxychlordane	191	299	322	205	226	338	364	264

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U072

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	86.5	85.1	-	-	107	97.9	-	-
Alpha-BHC	91.2	89.3	-	-	100	100	-	-
Gamma-BHC	89.2	88.8	-	-	98.0	98.2	-	-
Mirex	91.7	91.5	-	-	106	104	-	-
p,p'-DDE	88.4	89.3	-	-	99.9	101	-	-
p,p'-DDD	89.1	94.0	-	-	104	108	-	-
p,p'-DDT	87.0	86.1	-	-	106	106	-	-
Heptachlor epoxide	-	-	97.2	99.5	-	-	100	100
Dieldrin	-	-	95.3	90.9	-	-	97.6	95.4
Alpha-Chlordane	-	-	96.0	99.2	-	-	97.1	100
Gamma-Chlordane	-	-	96.3	100	-	-	104	103
Oxychlordane	-	-	96.3	97.6	-	-	103	100

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	83.8	81.5	63.8	44.9	108	106	99.5	74.1
Alpha-BHC	109	123	58.7	80.9	105	126	100	98.2
Gamma-BHC	78.7	88.4	85.4	84.8	93.3	100	109	96.7
Mirex	101	101	97.9	82.6	105	103	107	93.6
p,p'-DDE	152	128	117	93.4	162	118	104	93.4
p,p'-DDD	97.6	99.2	90.0	104	112	100	99.9	97.6
p,p'-DDT	160	139	108	112	214	161	143	116
Heptachlor epoxide	76.9	73.3	85.1	76.5	65.5	69.9	91.3	74.0
Dieldrin	96.3	93.7	83.2	93.2	100	100	100	100
Alpha-Chlordane	99.2	97.3	98.6	84.8	107	103	100	96.7
Gamma-Chlordane	98.4	98.0	99.1	80.6	114	109	109	91.1
Oxychlordane	95.1	95.1	88.6	77.7	113	108	100	100

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U077

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	92.7	92.7	-	-	115	107	-	-
Alpha-BHC	122	122	-	-	134	137	-	-
Gamma-BHC	80.3	80.3	-	-	88.3	88.9	-	-
Mirex	81.0	81.0	-	-	93.6	91.7	-	-
p,p'-DDE	84.4	84.4	-	-	95.3	95.2	-	-
p,p'-DDD	85.3	85.3	-	-	100	97.8	-	-
p,p'-DDT	86.4	72.7	-	-	100	89.2	-	-
Heptachlor epoxide	-	-	88.6	88.6	-	-	91.1	89.1
Dieldrin	-	-	76.7	79.1	-	-	78.6	82.9
Alpha-Chlordane	-	-	98.9	98.9	-	-	100	100
Gamma-Chlordane	-	-	92.0	94.1	-	-	98.9	96.8
Oxychlordane	-	-	93.9	93.9	-	-	100	96.2

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	88.8	88.8	76.9	76.9	115	115	120	127
Alpha-BHC	124	128	71.4	114	119	130	122	139
Gamma-BHC	80.3	80.3	62.2	78.3	95.2	90.9	79.5	89.2
Mirex	62.5	80.9	67.0	64.2	64.6	82.1	73.1	72.8
p,p'-DDE	50.9	71.9	87.4	75.7	53.8	66.7	77.3	75.7
p,p'-DDD	55.6	75.9	90.1	91.1	63.6	76.0	100	85.6
p,p'-DDT	55.1	90.6	89.2	98.0	73.7	105	118	102
Heptachlor epoxide	48.6	60.7	64.8	61.8	41.4	57.9	69.6	59.8
Dieldrin	52.0	70.6	76.9	73.1	54.1	75.4	92.3	78.5
Alpha-Chlordane	60.8	79.8	84.8	81.9	65.8	84.7	86.0	93.5
Gamma-Chlordane	57.4	73.8	82.8	78.7	66.8	81.8	91.0	89.0
Oxychlordane	61.2	77.6	77.5	75.4	72.6	87.8	87.5	97.1

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U086

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	73.4	69.5	-	-	90.7	79.9	-	-
Alpha-BHC	76.3	76.3	-	-	83.7	85.5	-	-
Gamma-BHC	100	88.4	-	-	110	97.8	-	-
Mirex	81.0	75.5	-	-	93.6	85.4	-	-
p,p'-DDE	88.0	83.5	-	-	99.4	94.2	-	-
p,p'-DDD	83.3	87.3	-	-	97.7	100	-	-
p,p'-DDT	92.3	84.5	-	-	113	104	-	-
Heptachlor epoxide	-	-	NA	NA	-	-	NA	NA
Dieldrin	-	-	NA	NA	-	-	NA	NA
Alpha-Chlordane	-	-	NA	NA	-	-	NA	NA
Gamma-Chlordane	-	-	94.1	100	-	-	101	103
Oxychlordane	-	-	NA	NA	-	-	NA	NA

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	77.2	77.2	73.1	82.7	100	100	114	137
Alpha-BHC	57.3	7.63	10.5	81.0	54.9	7.77	17.9	98.3
Gamma-BHC	72.3	24.9	35.1	54.2	85.7	28.2	44.9	61.8
Mirex	73.5	80.9	67.9	75.2	76.0	82.1	74.1	85.3
p,p'-DDE	86.3	129	117	99.1	92.3	120	104	99.1
p,p'-DDD	79.4	71.4	89.1	109	90.9	72.0	99.0	102
p,p'-DDT	74.8	38.2	52.0	95.1	100	44.1	68.9	98.5
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	82.0	90.2	81.8	92.0	95.2	100	89.8	104
Oxychlordane	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U091

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	21.2	21.2	-	-	26.3	24.4	-	-
Alpha-BHC	91.6	91.6	-	-	100	103	-	-
Gamma-BHC	88.4	88.4	-	-	97.1	97.8	-	-
Mirex	86.6	86.6	-	-	100	97.9	-	-
p,p'-DDE	88.0	88.0	-	-	99.4	99.2	-	-
p,p'-DDD	91.3	91.3	-	-	107	105	-	-
p,p'-DDT	88.4	88.4	-	-	108	108	-	-
Heptachlor epoxide	-	-	106	109	-	-	109	109
Dieldrin	-	-	97.7	97.7	-	-	100	102
Alpha-Chlordane	-	-	103	105	-	-	104	106
Gamma-Chlordane	-	-	98.2	100	-	-	105	103
Oxychlordane	-	-	93.9	98.0	-	-	100	100

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Mirex	NA	NA	NA	NA	NA	NA	NA	NA
p,p'-DDE	NA	NA	NA	NA	NA	NA	NA	NA
p,p'-DDD	NA	NA	NA	NA	NA	NA	NA	NA
p,p'-DDT	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA
Oxychlordane	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U092

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	46.3	46.3	-	-	57.3	53.3	-	-
Alpha-BHC	84.0	84.0	-	-	92.1	94.0	-	-
Gamma-BHC	88.4	88.4	-	-	97.1	97.8	-	-
Mirex	82.9	84.7	-	-	95.7	95.8	-	-
p,p'-DDE	91.6	91.6	-	-	103	103	-	-
p,p'-DDD	85.3	83.3	-	-	100	95.6	-	-
p,p'-DDT	70.7	72.7	-	-	86.5	89.2	-	-
Heptachlor epoxide	-	-	91.1	88.6	-	-	93.8	89.1
Dieldrin	-	-	83.7	83.7	-	-	85.7	87.8
Alpha-Chlordane	-	-	95.1	93.2	-	-	96.2	94.2
Gamma-Chlordane	-	-	92.0	90.0	-	-	98.9	92.6
Oxychlordane	-	-	77.6	77.6	-	-	82.6	79.5

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	50.2	57.9	56.7	59.6	65.0	75.0	88.5	98.4
Alpha-BHC	99.2	101	53.3	100	95.2	103	90.9	121
Gamma-BHC	104	96.4	73.3	101	124	109	93.6	116
Mirex	91.9	95.6	82.6	93.6	95.1	97.0	90.2	106
p,p'-DDE	93.5	108	108	101	100	100	95.6	101
p,p'-DDD	87.3	103	89.1	104	100	104	99.0	97.7
p,p'-DDT	51.2	59.1	49.0	53.9	68.4	68.2	65.0	55.8
Heptachlor epoxide	72.9	81.0	65.9	67.9	62.1	77.2	70.7	65.7
Dieldrin	85.5	89.2	77.8	80.6	88.8	95.2	93.4	86.4
Alpha-Chlordane	87.5	103	85.7	87.6	94.7	109	87.0	100
Gamma-Chlordane	86.1	98.4	85.9	86.9	100	109	94.4	98.3
Oxychlordane	73.5	81.6	69.3	72.4	87.2	92.4	78.3	93.2

TABLE 4

Percent Recovery of the Design Value and the Median

$$\frac{\text{Reported value}}{\text{Design/Median}} \times 100$$

Lab Code: U093

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	801	802	803	804	801	802	803	804
HCB	52.1	52.1	-	-	64.4	59.9	-	-
Alpha-BHC	87.8	84.0	-	-	96.2	94.0	-	-
Gamma-BHC	92.4	92.4	-	-	102	102	-	-
Mirex	88.4	88.4	-	-	102	100	-	-
p,p'-DDE	84.4	82.6	-	-	95.3	93.2	-	-
p,p'-DDD	75.4	73.4	-	-	88.4	84.2	-	-
p,p'-DDT	72.7	70.7	-	-	88.9	86.7	-	-
Heptachlor epoxide	-	-	86.1	86.1	-	-	88.5	86.5
Dieldrin	-	-	81.4	83.7	-	-	83.3	87.8
Alpha-Chlordane	-	-	91.3	93.2	-	-	92.3	94.2
Gamma-Chlordane	-	-	85.9	87.9	-	-	92.3	90.5
Oxychlordane	-	-	77.6	77.6	-	-	82.6	79.5

Parameter	% Recovery of Design Value				% Recovery of Interlaboratory Median			
	Sample				Sample			
	805	806	807	808	805	806	807	808
HCB	46.3	57.9	36.5	38.5	60.0	75.0	57.0	63.5
Alpha-BHC	91.6	95.4	37.6	100	87.8	97.1	64.1	121
Gamma-BHC	116	169	72.3	118	138	191	92.3	135
Mirex	199	162	124	112	205	104	135	127
p,p'-DDE	155	194	132	128	165	180	116	128
p,p'-DDD	123	190	93.1	118	141	192	103	111
p,p'-DDT	142	86.6	78.4	123	189	100	104	127
Heptachlor epoxide	117	121	93.2	103	100	116	100	100
Dieldrin	123	134	92.6	108	127	143	111	116
Alpha-Chlordane	133	167	107	123	144	177	108	140
Gamma-Chlordane	135	148	96.1	107	157	164	106	121
Oxychlordane	122	196	91.7	102	145	222	104	131

TABLE 5

Summary of % Recovery of the Design Value

(see page 4)

Lab	Parameter	Comments on Sample Results
U001	p,p'-DDD	801, 805, 806, 808 -low
	p,p'-DDT	807, 808 - low
	Heptachlor epoxide	807 - high
	Dieldrin	806 - low
U013	HCB	805 - v. low; 806 - low
	α - BHC	
	γ - BHC	805 - low
	p,p'-DDD	
	γ - chlordane	
	p,p'-DDT	801, 802, 805, 806 - low
	p,p'-DDE	805, 806 - low
	α-chlordane	
	oxychlordane	
U014	HCB	805, 807, 808 - low
	γ - BHC	801, 802 - high
	p,p'-DDD	802 - high
	p,p'-DDT	801, 805, 807, 808 - low
	heptachlor epoxide	803, 804 - v. high; 805, 806, 807, 808 - high

TABLE 5 (continued)

Summary of % Recovery of the Design Value

Lab	Parameter	Comments on Sample Results
U063	HCB	801,802 - v. high; 806-high; 807,808-v. low
	α-BHC	801,802,805,806 - v. high; 808 - very low
	γ-BHC	801,802,805,806,807-v. high; 808 - v. low
	Mirex	801,802,805,806,807,808 - very high
	p,p,-DDE	
	p,p'-DDD	
	p,p'-DDT	801,802,807,808 - very high; 806 - high
	heptachlor epoxide	803,804,806,807 - very high; 805-high
	Dieldrin	803,804,805,806,808 - very high; 807-very low
	α-chlordane	803,804,805,806,807,808-very high
	oxychlordane	
U072	HCB	807 - low; 808 - very low
	α-BHC	807 - low
	p,p'-DDE	805 - very high; 806 - high
	p,p'-DDT	
	heptachlor epoxide	806 - low
U077	α-BHC	806 - high, 807 - low
	γ-BHC	807 - low
	mirex	805, 807, 808 - low
	p,p'-DDE	805, 806 - low
	α-chlordane	805 - low
	p,p'-DDT	802, 805 - low
	p,p'-DDD	805 - low
	γ-chlordane	
	oxychlordane	
	heptachlor epoxide	805 - very low; 806, 807, 808 - low
	Dieldrin	805, 806, 808 - low

TABLE 5 (continued)

Lab	Parameter	Comments on Sample Results
U086	HCB	801, 802, 807 - low
	α-BHC	805 - low; 806, 807 - very low
	γ-BHC	805, 808 - low; 806, 807 - very low
	Mirex	805, 807 - low
	p,p'-DDE	806 - high
	p,p'-DDD	806 - low
	p,p'-DDT	806 - very low; 805, 807 - low
U091	HCB	801, 802 - very low
U092	HCB	801, 802 - very low; 805 - 808 - low
	α-BHC	807 - low
	γ-BHC	
	p,p'-DDT	801,802,805,806,808 - low; 807 - very low
	heptachlor epoxide	805, 807, 808 - low
	oxychlordane	
U093	HCB	801,802,806 - low; 805,807,808 - very low
	α-BHC	807 - very low
	γ-BHC	806 - very high; 807 - low
	mirex	805, 806 - very high
	p,p'-DDE	805, 806 - very high; 807, 808 - high
	p,p'-DDD	802 - low; 806 - very high
	p,p'-DDT	801, 802 - low; 805 - high
	dieldrin	806 - high
	α-chlordane	805 - high; 806 - very high
	γ-chlordane	805, 806 - high
	oxychlordane	806 - very high

APPENDIX I

Codes

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

APPENDIX II

UGLCC Interlaboratory Performance Evaluation Study

QM-8 Organochlorines in Ampules and Water

Final Data Summary

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: HCB PG/UL

SAMPLE RESULTS

LAB	801	802
U001	39.0	46.5
U013	47.0	46.0
U014	47.	49.
U063	281.	293.
U072	44.8	44.1
U077	48.	48.
U086	38.	36.
U091	11.	11.
U092	24.	24.
U093	27.0	27.0
TOTAL LABS REPORTING	10	10
TOTAL LABS USED	10	10
MEAN	60.68000	62.46000
STD DEV	78.35845	81.98004
MEDIAN	41.90000	45.05000
GN VALUE	51.8	51.8

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: ALPHA-BHC PG/UL

SAMPLE RESULTS

LAB	801	802
U001	22.6	23.2
U013	27.0	27.0
U063	131.	137.
U072	23.9	23.4
U077	32.	32.
U086	20.	20.
U091	24.	24.
U092	22.	22.
U093	23.0	22.0
TOTAL LABS REPORTING	9	9
TOTAL LABS USED	9	9
MEAN	36.16667	36.73333
STD DEV	35.72940	37.76202
MEDIAN	23.90000	23.40000
IGN VALUE	26.2	26.2

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: GAMMA-BHC PG/UL

SAMPLE RESULTS

LAB	801	802
U001	22.3	22.9
U013	27.0	25.0
U014	33.	36.
U063	119.	120.
U072	22.2	22.1
U077	20.	20.
U086	25.	22.
U091	22.	22.
U092	22.	22.
U093	23.0	23.0
TOTAL LABS REPORTING	10	10
TOTAL LABS USED	10	10
MEAN	33.55000	33.50000
STD DEV	30.24916	30.71793
MEDIAN	22.65000	22.50000
[redacted]IGN VALUE	24.9	24.9

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: MIREX PG/UL

SAMPLE RESULTS

LAB	801	802
U001	42.8	49.8
U014	50.	51.
U063	167.	182.
U072	49.8	49.7
U077	44.	44.
U086	44.	41.
U091	47.	47.
U092	45.	46.
U093	48.0	48.0
TOTAL LABS REPORTING	9	9
TOTAL LABS USED	9	9
MEAN	59.73333	62.05556
STD DEV	40.30856	45.08756
MEDIAN	47.00000	48.00000
IGN VALUE	54.3	54.3

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: P,P'-DDE PG/LL

SAMPLE RESULTS

LAB	801	802
U001	98.7	114.
U013	110.0	93.0
U014	123.	124.
U063	283.	296.
U072	98.5	99.5
U077	94.	94.
U086	98.	93.
U091	98.	98.
U092	102.	102.
U093	94.0	92.0
TOTAL LABS REPORTING	10	10
TOTAL LABS USED	10	10
MEAN	119.92000	120.55000
STD DEV	57.96347	62.51331
MEDIAN	98.60000	98.75000
GN VALUE	111.4	111.4

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: P,P'-DDD PG/UL

SAMPLE RESULTS

LAB	801	802
U001	32.6	43.9
U013	38.0	40.0
U014	62.	63.
U063	189.	200.
U072	44.9	47.4
U077	43.	43.
U086	42.	44.
U091	46.	46.
U092	43.	42.
U093	38.0	37.0
TOTAL LABS REPORTING	10	10
TOTAL LABS USED	10	10
MEAN	57.85000	60.63000
STD DEV	46.71848	49.46042
MEDIAN	43.00000	43.95000
IGN VALUE	50.4	50.4

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: P,P'-DDT PG/UL

SAMPLE RESULTS

LAB	801	802
U001	39.2	44.4
U013	36.0	33.0
U014	36.	40.
U063	147.	155.
U072	44.3	43.8
U077	44.	37.
U086	47.	43.
U091	45.	45.
U092	36.	37.
U093	37.0	36.0
TOTAL LABS REPORTING	10	10
TOTAL LABS USED	10	10
MEAN	51.15000	51.42000
STD DEV	33.94752	36.62367
MEDIAN	41.60000	41.50000
IGN VALUE	50.9	50.9

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: HEPTACHLOR EPOXIDE PG/UL

SAMPLE RESULTS

LAB	803	804	
U001	48.2	46.1	
U013	38.0	38.0	
U014	67.	69.	
U063	149.	151.	
U072	38.4	39.3	
U077	35.	35.	
U091	42.	43.	
U092	36.	35.	
U093	34.0	34.0	
TOTAL LABS REPORTING	9	9	9
TOTAL LABS USED	9	9	0
MEAN	54.17778	54.48889	
STD DEV	37.00628	37.76465	
MEDIAN	38.40000	39.30000	
GN VALUE	39.5	39.5	

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: DIELDRIN PG/LL

SAMPLE RESULTS

LAB	803	804
U001	44.8	42.9
U013	48.0	46.0
U014	42.	41.
U063	136.	136.
U072	41.0	39.1
U077	33.	34.
U091	42.	42.
U092	36.	36.
U093	35.0	36.0
TOTAL LABS REPORTING	9	9
TOTAL LABS USED	9	9
MEAN	50.86667	50.33333
STD DEV	32.28637	32.35201
MEDIAN	42.00000	41.00000
[illegible]IGN VALUE	43.0	43.0

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: ALPHA-CHLORDANE PG/UL

SAMPLE RESULTS

LAB	803	804
U001	53.2	51.8
U013	40.0	44.0
U014	58.	59.
U063	209.	209.
U072	50.5	52.2
U077	52.	52.
U091	54.	55.
U092	50.	49.
U093	48.0	49.0
TOTAL LABS REPORTING	9	9
TOTAL LABS USED	9	9
MEAN	68.30000	69.00000
STD DEV	52.99231	52.66412
MEDIAN	52.00000	52.00000
DESIGN VALUE	52.6	52.6

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: GAMMA-CHLORDANE PG/UL

SAMPLE RESULTS

LAB	803	804
U001	44.2	42.4
U013	42.0	44.0
U014	55.	56.
U063	193.	194.
U072	47.1	49.0
U077	45.	46.
U086	46.	49.
U091	48.	49.
U092	45.	44.
U093	42.0	43.0
TOTAL LABS REPORTING	10	10
TOTAL LABS USED	10	10
MEAN	60.73000	61.64000
STD DEV	46.62227	46.68436
MEDIAN	45.50000	47.50000
IGN VALUE	48.9	48.9

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: OXYCHLORDANE PG/UL

SAMPLE RESULTS

LAB	803	804
U013	30.0	28.0
U063	61.3	63.2
U072	23.6	23.9
U077	23.	23.
U091	23.	24.
U092	19.	19.
U093	19.0	19.0
TOTAL LABS REPORTING	7	7
TOTAL LABS USED	7	7
MEAN	28.41429	28.58571
STD DEV	14.96133	15.58016
MEDIAN	23.00000	23.90000
DESIGN VALUE	24.5	24.5

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: HCB NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	20.6	20.8	86.8	86.3
U013	1.8	17.0		
U014	19.	20.	67.	64.
U063	29.2	32.7	6.19	1.32
U072	21.7	21.1	66.3	46.7
U077	23.	23.	80.	80.
U086	20.	20.	76.	86.
U092	13.	15.	59.	62.
U093	12.0	15.0	38.0	40.0
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	9	8	8
MEAN	17.81111	20.51111	59.91125	58.54000
STD DEV	7.89785	5.34777	26.30422	29.03217
MEDIAN	20.00000	20.00000	66.65000	63.00000
SIGN VALUE	25.9	25.9	104	104

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: ALPHA-BHC NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	59.7	47.7	176.	173.
U013	14.0	38.0		
U063	164.	223.	194.	4.77
U072	57.3	64.7	123.2	169.8
U077	65.	67.	150.	240.
U086	30.	4.0	22.	170.
U092	52.	53.	112.	210.
U093	48.0	50.0	79.0	210.0
TOTAL LABS REPORTING	8	8	8	8
TOTAL LABS USED	8	8	7	7
MEAN	61.25000	68.42500	122.31429	168.22429
STD DEV	44.81690	65.45722	58.92615	76.79835
MEDIAN	54.65000	51.50000	123.20000	173.00000
DESIGN VALUE	52.4	52.4	210	210

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: GAMMA-BHC NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	23.4	18.9	91.8	90.3
U013	13.0	20.0		
U014	21.	23.	83.	96.
U063	72.3	90.3	201.	20.8
U072	19.6	22.0	85.1	84.5
U077	20.	20.	62.	78.
U086	18.	6.2	35.	54.
U092	26.	24.	73.	101.
U093	29.0	42.0	72.0	118.0
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	9	8	8
MEAN	26.92222	29.60000	87.86250	80.32500
STD DEV	17.63078	24.53900	48.96456	30.35771
MEDIAN	21.00000	22.00000	78.00000	87.40000
DESIGN VALUE	24.9	24.9	99.6	99.6

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: MIREX NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	22.5	24.3	94.6	96.2
U014	28.	28.	105.	96.
U063	42.8	49.5	335.	353.
U072	27.6	27.6	106.7	90.0
U077	17.	22.	73.	70.
U086	20.	22.	74.	82.
U092	25.	26.	90.	102.
U093	54.0	44.0	135.0	122.0
TOTAL LABS REPORTING	8	8	8	8
TOTAL LABS USED	8	8	8	8
MEAN	29.61250	30.42500	126.66250	126.40000
STD DEV	12.52796	10.42699	86.49272	92.79452
MEDIAN	26.30000	26.80000	99.80000	96.10000
DESIGN VALUE	27.2	27.2	109	109

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: P,P'-DDE NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	23.5	22.2	121.	114.
U013	17.0	19.0		
U014	28.	30.	108.	108.
U063	72.1	83.2	226.	217.
U072	42.2	35.5	130.0	103.7
U077	14.	20.	97.	84.
U086	24.	36.	130.	110.
U092	26.	30.	120.	112.
U093	43.0	54.0	146.0	142.0
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	9	8	8
MEAN	32.20000	36.65556	134.75000	123.83750
STD DEV	17.92324	20.48067	39.72315	40.84969
MEDIAN	26.00000	30.00000	125.50000	111.00000
IGN VALUE	27.8	27.8	111	111

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: P,P'-DDD NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	18.8	14.6	84.1	74.7
U013	16.0	20.0		
U014	28.	28.	105.	110.
U063	43.3	60.6	278.	263.
U072	24.6	25.0	90.9	104.9
U077	14.	19.	91.	92.
U086	20.	18.	90.	110.
U092	22.	26.	90.	105.
U093	31.0	48.0	94.0	119.0
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	9	8	8
MEAN	24.18889	28.80000	115.37500	122.32500
STD DEV	9.00395	15.38896	65.97672	58.42682
MEDIAN	22.00000	25.00000	90.95000	107.50000
DESIGN VALUE	25.2	25.2	101	101

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: P,P'-DDT NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	23.2	20.5	73.9	58.6
U013	19.0	18.0		
U014	19.	22.	66.	64.
U063	22.4	31.9	178.	184.
U072	40.6	35.4	110.0	114.3
U077	14.	23.	91.	100.
U086	19.	9.7	53.	97.
U092	13.	15.	50.	55.
U093	36.0	22.0	80.0	125.0
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	9	8	8
MEAN	22.91111	21.94444	87.73750	99.73750
STD DEV	9.40803	7.88259	41.41818	42.97657
MEDIAN	19.00000	22.00000	76.95000	98.50000
[illegible]IGN VALUE	25.4	25.4	102	102

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: HEPTACHLOR EPOXIDE NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	29.9	25.9	127.	122.
U014	36.	32.	132.	147.
U063	36.7	58.8	222.	165.
U072	19.0	18.1	84.0	75.5
U077	12.	15.	64.	61.
U092	18.	20.	65.	67.
U093	29.0	30.0	92.0	102.0
TOTAL LABS REPORTING	7	7	7	7
TOTAL LABS USED	7	7	7	7
MEAN	25.80000	28.54286	112.28571	105.64286
STD DEV	9.55179	14.73090	55.40973	40.63938
MEDIAN	29.00000	25.90000	92.00000	102.00000
DESIGN VALUE	24.7	24.7	98.7	98.7

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: DIELDRIN NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	25.3	19.2	112.	100.
U014	30.	28.	101.	128.
U063	65.6	85.9	6.41	226.
U072	25.9	25.2	89.9	100.7
U077	14.	19.	83.	79.
U092	23.	24.	84.	87.
U093	33.0	36.0	100.0	117.0
TOTAL LABS REPORTING	7	7	7	7
TOTAL LABS USED	7	7	7	7
MEAN	30.97143	33.90000	82.33000	119.67143
STD DEV	16.39946	23.64678	35.03688	49.75060
MEDIAN	25.90000	25.20000	89.90000	100.70000
DESIGN VALUE	26.9	26.9	108	108

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: ALPHA-CHLORDANE NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	24.6	22.0	107.	98.2
U013	17.0	18.0		
U014	24.	24.	87.	90.
U063	64.3	87.7	286.	220.
U072	26.1	25.6	103.5	89.0
U077	16.	21.	89.	86.
U092	23.	27.	90.	92.
U093	35.0	44.0	112.0	129.0
TOTAL LABS REPORTING	8	8	8	8
TOTAL LABS USED	8	8	7	7
MEAN	28.75000	33.66250	124.92857	114.88571
STD DEV	15.50742	23.21126	71.69520	48.60410
MEDIAN	24.30000	24.80000	103.50000	92.00000
DESIGN VALUE	26.3	26.3	105	105

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: GAMMA-CHLORDANE NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U001	20.8	18.6	95.8	84.5
U013	14.0	21.0		
U014	21.	22.	80.	88.
U063	56.5	80.2	259.	219.
U072	24.0	23.9	96.9	78.8
U077	14.	18.	81.	77.
U086	20.	22.	80.	90.
U092	21.	24.	84.	85.
U093	33.0	36.0	94.0	105.0
TOTAL LABS REPORTING	9	9	9	9
TOTAL LABS USED	9	9	8	8
MEAN	24.92222	29.52222	108.83750	103.41250
STD DEV	13.10456	19.71724	61.10464	47.48011
MEDIAN	21.00000	22.00000	89.00000	86.50000
IGN VALUE	24.4	24.4	97.8	97.8

QM8 ORGANOCHLORINES IN AMPULES AND WATER

PRINTOUT PREPARED: 86/11/21.

PARAMETER: OXYCHLORDANE NG/L

SAMPLE RESULTS

LAB	805	806	807	808
U013	16.0	18.0		
U063	46.7	73.2	316.	201.
U072	23.3	23.3	86.3	76.2
U077	15.	19.	76.	74.
U092	18.	20.	68.	71.
U093	30.0	48.0	90.0	100.0
TOTAL LABS REPORTING	6	6	6	6
TOTAL LABS USED	6	6	5	5
MEAN	24.83333	33.58333	127.38000	104.44000
STD DEV	12.07156	22.46370	105.80559	55.19482
MEDIAN	20.65000	21.65000	86.90000	76.20000
DESIGN VALUE	24.5	24.5	98.1	98.1