WHAT HAPPENS TO PCBs IN THE ENVIRONMENT?

1. PCBs ARE MAN MADE.

2. WE CANNOT DETERMINE IF THEY DEGRADE IN THE ENVIRONMENT FROM THE TOTAL CONCENTRATIONS FOUND THERE.

3. THE PCBs ARE MIXTURES OF HOMOLOGS.

4. THEREFORE, COMPARISON OF HOMOLOG RATIOS IN "ENVIRONMENTALLY AGED SAMPLES" WITH HOMOLOG RATIOS IN MATERIAL PRODUCED CAN BE USED TO GAIN INSIGHT AS TO WHAT IS HAPPENING IN THE ENVIRONMENT.

DSW 346878

HOW DO WE GET THE DATA NEEDED?

1. PRODUCTION FIGURES FOR ALL MONSANTO PCB PRODUCTS AND HOMOLOG CONTENT OF EACH PRODUCT ARE AVAILABLE FOR 1957-71. WE USE THESE DATA TO CALCULATE HOMOLOG RATIOS FOR 1957-71 PRODUCTION.

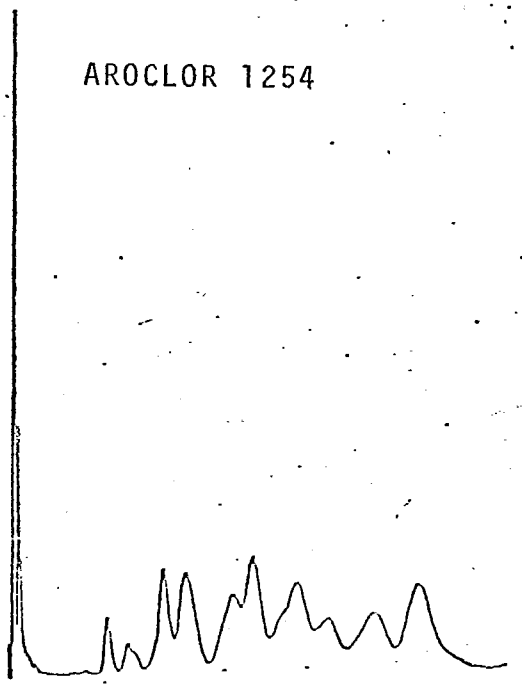
2. EUROPEAN PRODUCERS MAKE SIMILAR PRODUCTS IN ABOUT THE SAME RATIOS AS MONSANTO.

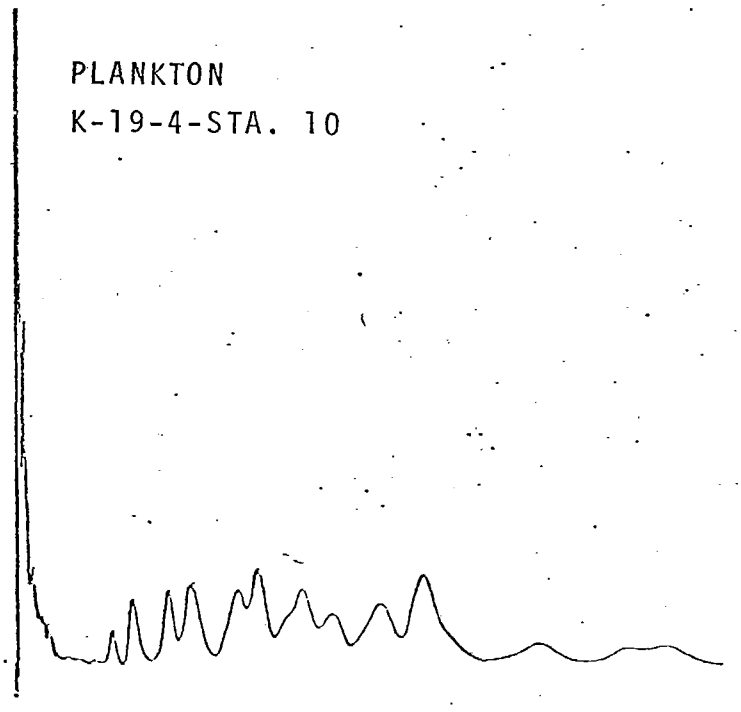
3. PRODUCTION BEFORE '57 WOULD NOT AFFECT THE FIGURES GREATLY SINCE PRODUCT RATIOS WERE SIMILAR AND PRODUCTION SMALLER.

4. ANALYSTS GENERALLY AGREE THAT MATERIAL FOUND IN "AGED ENVIRONMENTAL SAMPLES" IS SIMILAR TO AROCLOR 1254 OR IN RARE CASES EVEN TO AROCLOR 1260.

DSW 346879

HARVEY, MIKLAS AND BOWEN 1254 VS
ENVIRONMENTAL MATERIAL CURVES





DSW 346880

DSW 346881

STLCOPCB4084854

A COMPARISON OF THE HOMOLOG RATIOS FOR PCBs SOLD WITH THOSE FOUND IN AGED ENVIRONMENTAL SAMPLES

	HOMOLOG								
	0	1	2	3	4	5	6	7	8
U.S. SALES '57 - '71	0.1	1.3	14.8	29.9	21.9	16.1	10.5	4.2	1.1%
AROCLOR 1254	<.1	<.1	<.5	1	21	48	23	6	ND

CONCLUSIONS

1. THERE ARE MARKED DIFFERENCES BETWEEN THE RATIOS OF HOMOLOGS IN PCBs FOUND IN "AGED ENVIRONMENTAL SAMPLES" AND THE RATIO OF HOMOLOGS FOR MATERIAL PRODUCED.

2. THESE DIFFERENCES CAN BEST BE EXPLAINED BY ASSUMING THAT THE PCBs WITH 3 OR LESS CHLORINE ATOMS PER MOLECULE DEGRADE MUCH MORE RAPIDLY THAN THE HIGHER HOMOLOGS.

3. THE HOMOLOG RATIO DATA DO NOT GIVE INFORMATION ON THE RATE OF DEGRADATION OF HIGHER HOMOLOGS. HOWEVER, SEMI-CONTINUOUS ACTIVATED SLUDGE TEST DATA SHOW THAT THESE TOO DEGRADE BUT AT A SLOWER RATE.

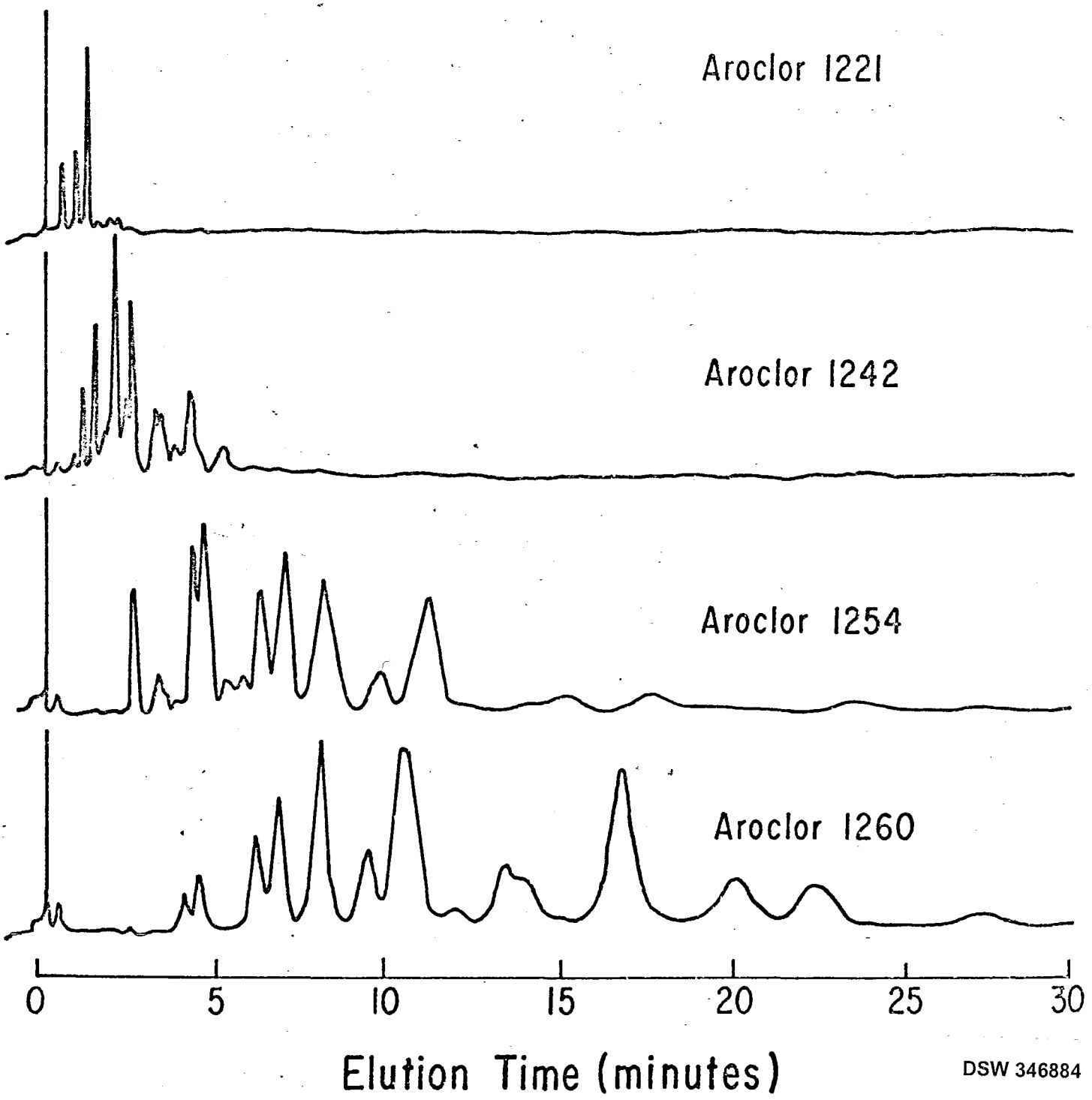
DSW 346882

ASSESSMENT OF THE PERSISTENCE OF POLYCHLORINATED BIPHENYLS IN BIOLOGICAL SYSTEMS

DSW 346883

STLCOPCB4084856

Electron Capture Gas Chromatograms



DSW 346884

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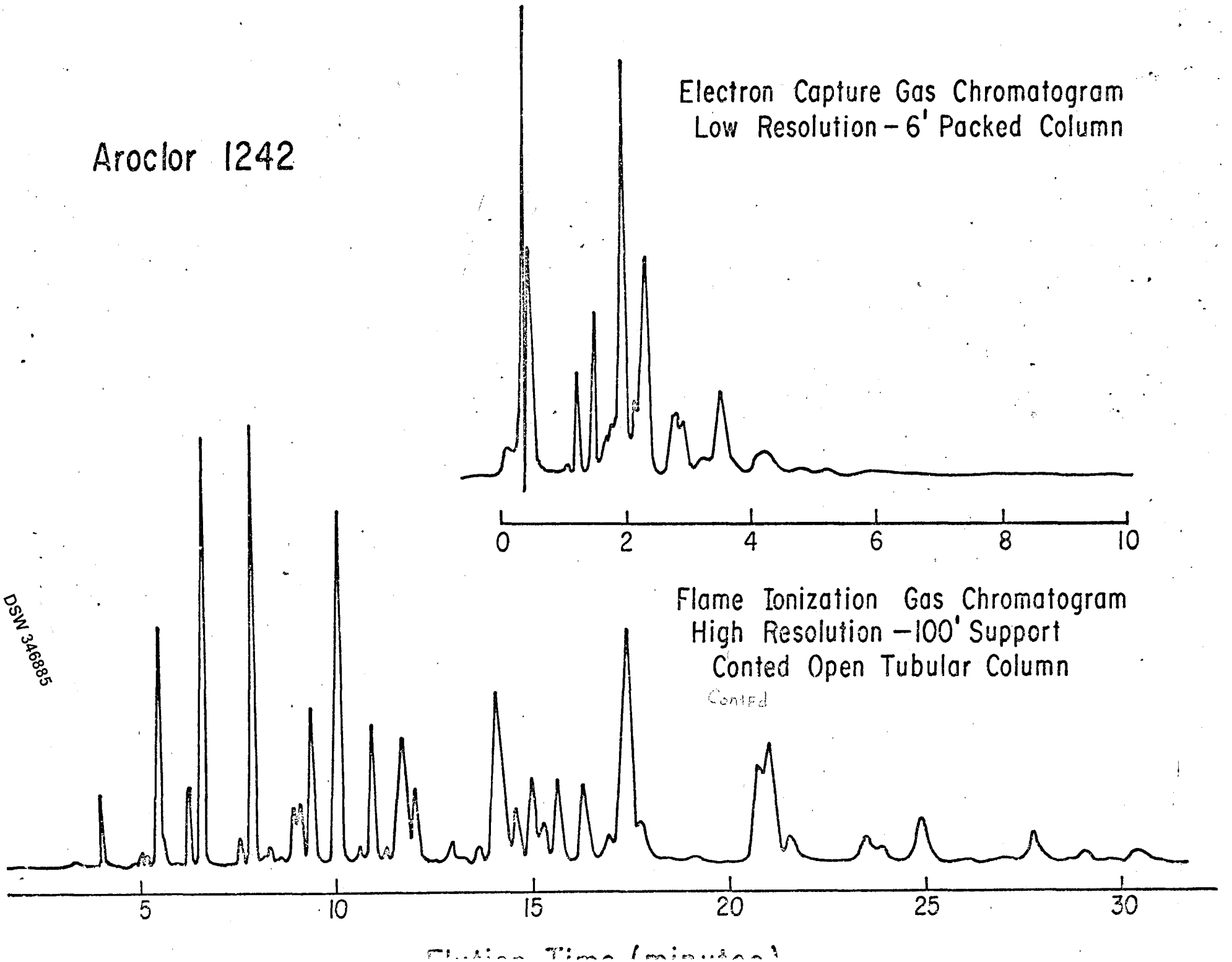


STLCOPCB4084858

PRIMARY BACTERIAL DEGRADATION STUDIES

- SEMI-CONTINUOUS ACTIVATED SLUDGE DEGRADATION

RESIDUE ACCUMULATION STUDIES

- FISH - CATFISH AND BLUEGILLS
- BIRDS - WHITE LEGHORN CHICKENS
- MAMMALS - ALBINO RATS AND BEAGLE DOGS

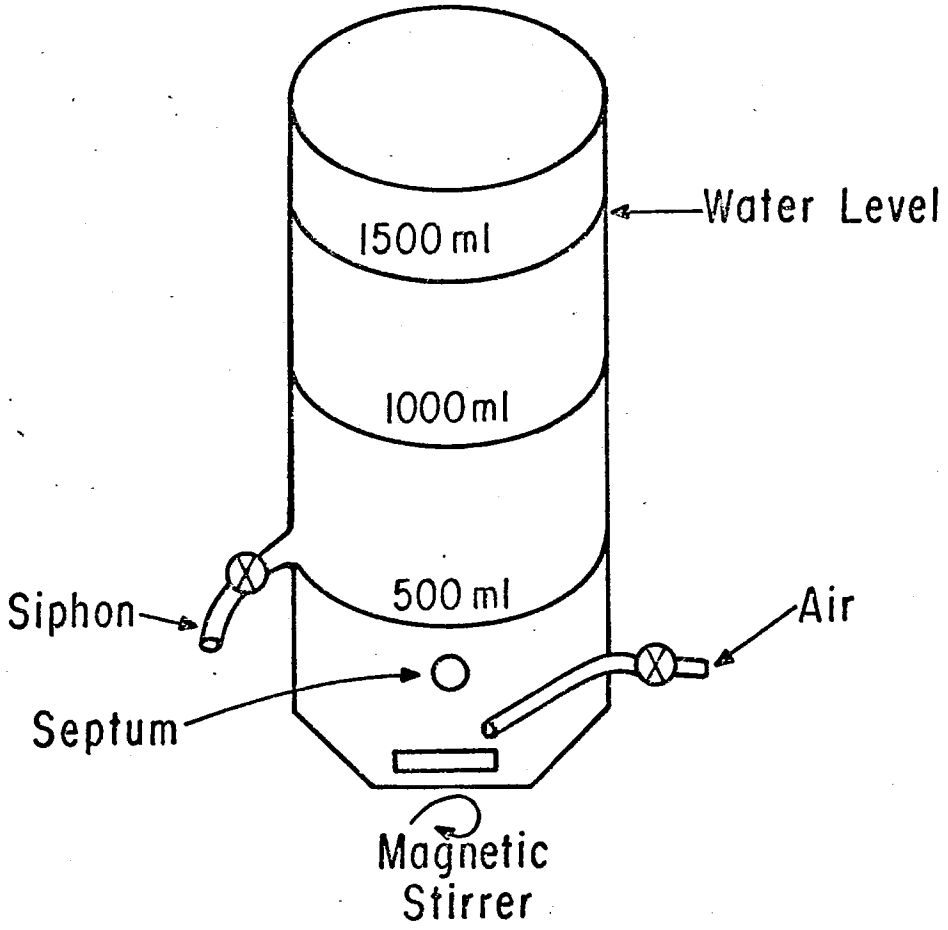
DSW 346886

AROCLOR SEMI-CONTINUOUS ACTIVATED SLUDGE PRIMARY DEGRADATION STUDIES

DSW 346887

Activated

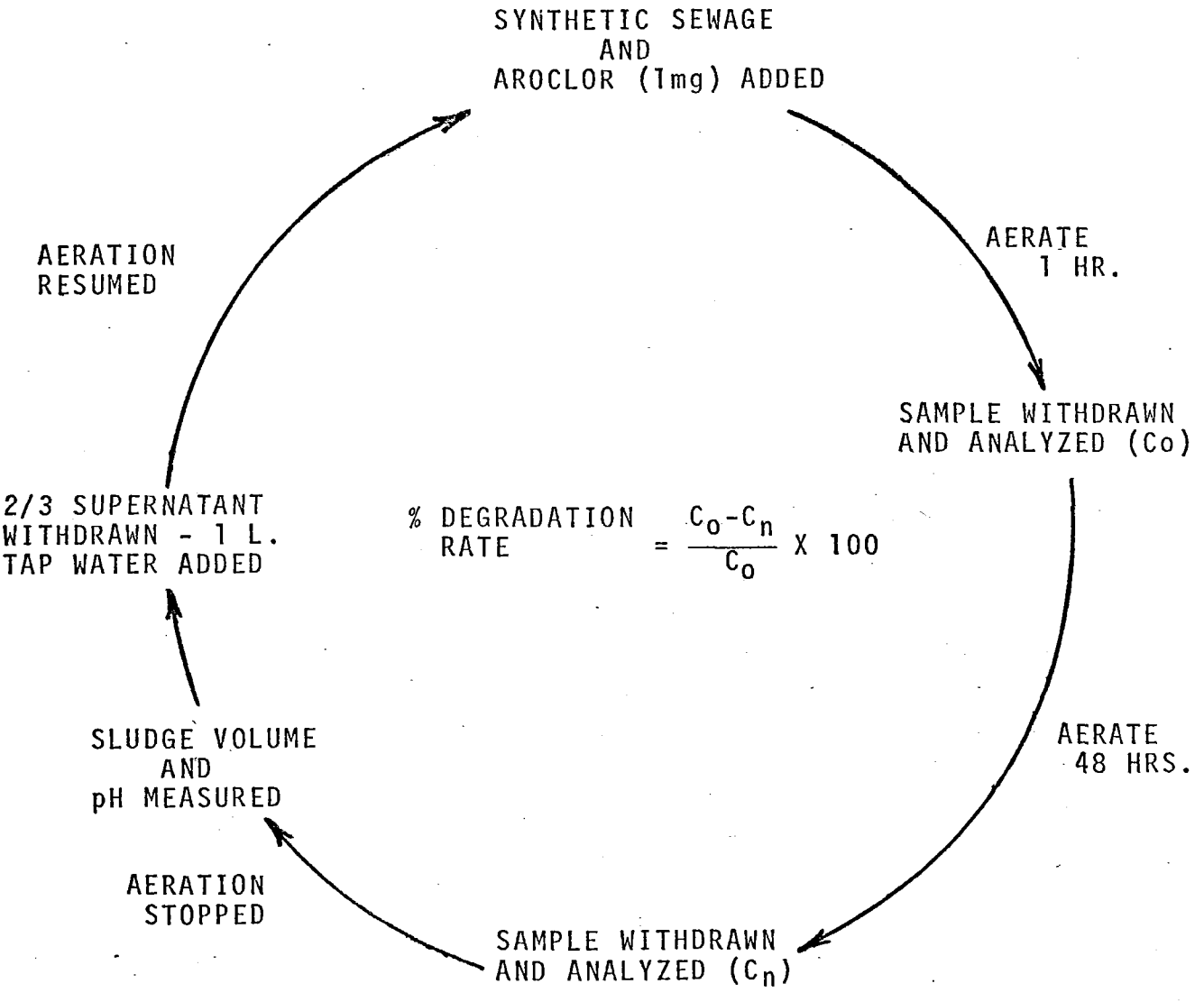
Semi-Continuous Activited Sludge Test Unit



DSW 346888

STLCOPCB4084861

MECHANICAL CYCLE



DSW 346889

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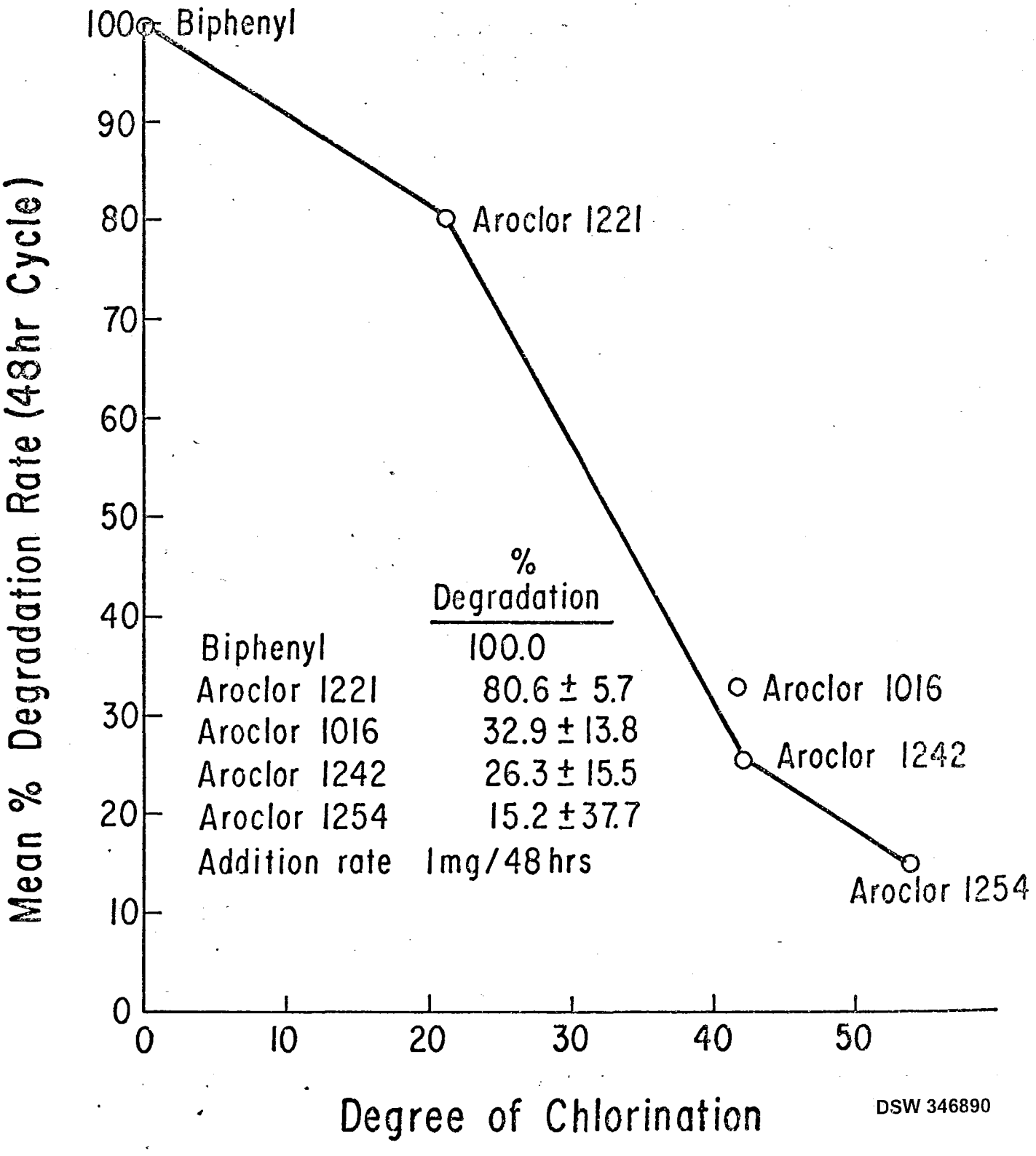
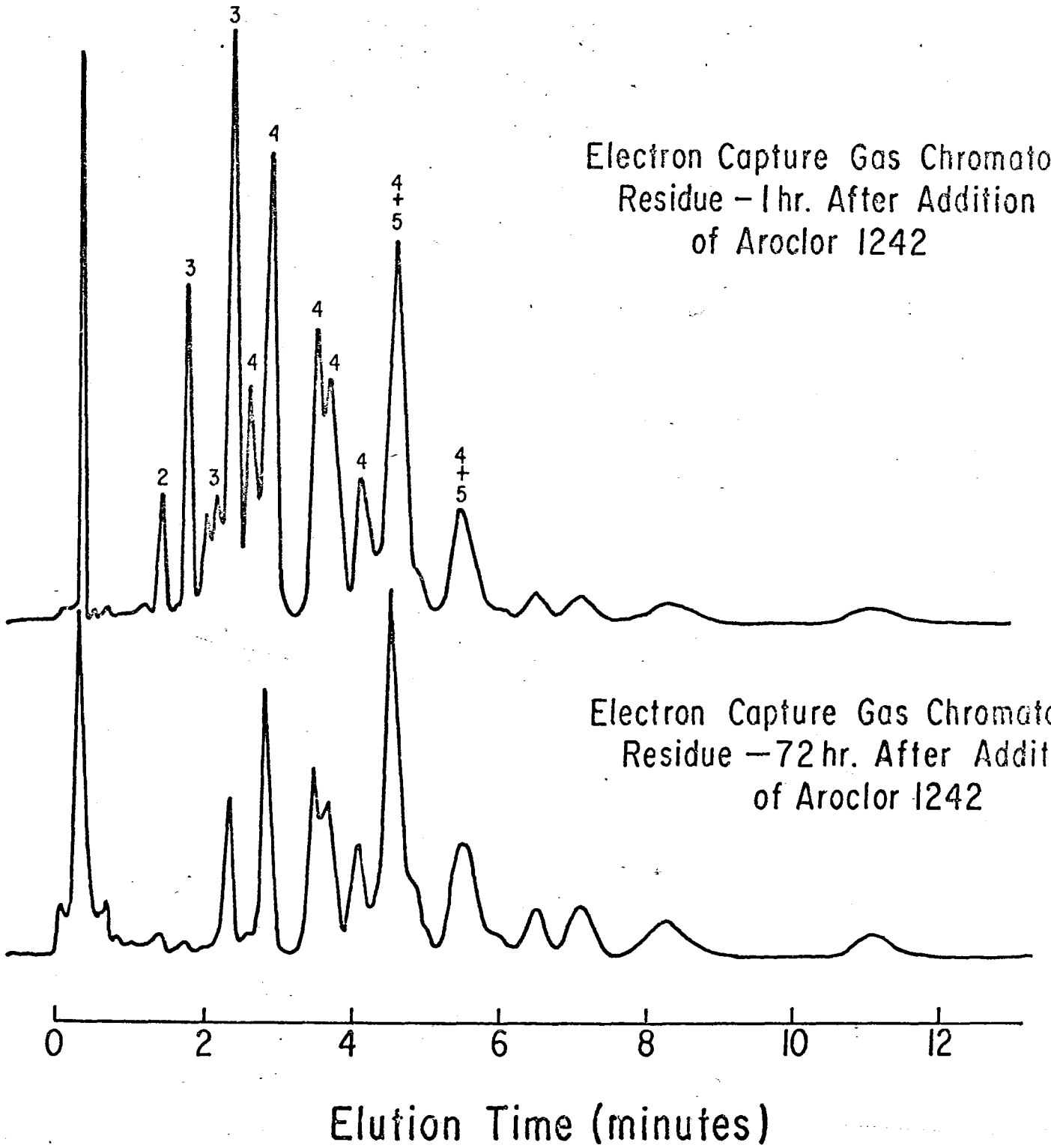
Semi-Continuous Activated Sludge Degradation of Polychlorinated Biphenyls



— % Chlorine (wt.)

STLCOPCB4084863

Semi-Continuous Activated Sludge Degradation of Aroclor 1242



DSW 346891

STLCOPCB4084864

- BIPHENYL, MONO-, DI-, TRI-, AND TETRACHLORO BIPHENYL HOMOLOGS CAN UNDERGO PRIMARY BACTERIAL DEGRADATION

- RATE OF PRIMARY DEGRADATION DECREASES AS THE DEGREE OF CHLORINATION OF THE AROCLOR PRODUCT IS INCREASED

BIPHENYL>AROCLOR 1221>>AROCLOR 1016>AROCLOR 1242>AROCLOR 1254

DSW 346892

AROCLOR RESIDUE STUDIES

DSW 346893

RESIDUE STUDIES* - CATFISH AND BLUEGILL FINGERLINGS

	21 DAY DYNAMIC
PRODUCTS STUDIED	AROCLOR 1016 AROCLOR 1242
NUMBER OF FISH	270
NUMBER OF SAMPLES WHOLE FISH	24
NUMBER OF SAMPLES ANALYZED WHOLE FISH	24

*BIONOMICS, INC.
WAREHAM, MASSACHUSETTS

DSW 346894

RESIDUE STUDIES* - WHITE LEGHORN CHICKENS

PRODUCTS STUDIED		CHICKENS REPRODUCTION RESIDUE AROCLOR 1242 AROCLOR 1254 AROCLOR 1260	AROCLOR 1242
NUMBER OF CHICKENS	FEMALE	200	80
	MALE	40	16
NUMBER OF SAMPLES	MUSCLE	40	8
	LIVER	40	8
	FAT	40	8
	EGGS	~250	~60
	CHICKS	30	10
NUMBER OF SAMPLES ANALYZED	MUSCLE	14	5
	LIVER	12	4
	FAT	18	5
	EGGS	25	8
	CHICKS	11	10
TOTAL SAMPLES COLLECTED		400	121
TOTAL ANALYZED		80	32

*INDUSTRIAL BIO-TEST LABORATORIES, INC.
NORTHBROOK, ILLINOIS

DSW 346895

STLCOPCB4084868

RESIDUE STUDIES* - ALBINO RATS

PRODUCTS STUDIED		30 DAY ORAL AROCLOR 1242 AROCLOR 1254 AROCLOR 1260	2 YEAR CHRONIC ORAL AROCLOR 1242 AROCLOR 1254 AROCLOR 1260	3 GENERATION RAT REPRODUCTION AROCLOR 1242 AROCLOR 1254 AROCLOR 1260	90 DAY SUBACUTE ORAL AROCLOR 1221
NUMBER OF RATS)	FEMALE	115	500	~20	60
	MALE	115	500	~20	60
NUMBER OF SAMPLES)	MUSCLE	18	33	-	7
	KIDNEY	18	-	-	-
	LIVER	18	33	-	7
	FAT	18	33	-	7
	PUPS	-	-	10	-
NUMBER OF SAMPLES ANALYZED)	MUSCLE	18	33	-	7
	KIDNEY	18	-	-	-
	LIVER	18	33	-	7
	FAT	18	33	-	7
	PUPS	-	-	10	-
TOTAL SAMPLES COLLECTED		144	198	20	42
TOTAL ANALYZED		72	99	10	21

*INDUSTRIAL BIO-TEST LABORATORIES, INC.
NORTHBROOK, ILLINOIS

DSW 346896

STLCOPCB4084869

RESIDUE STUDIES* - BEAGLE DOGS

		2 YEAR CHRONIC ORAL	90 DAY SUBACUTE ORAL
PRODUCTS STUDIED		AROCLOR 1242 AROCLOR 1254 AROCLOR 1260	AROCLOR 1221
NUMBER OF DOGS	FEMALE	40	14
	MALE	40	14
NUMBER OF SAMPLES	MUSCLE	54	7
	LIVER	54	7
	FAT	54	7
TOTAL SAMPLES COLLECTED		242	21
NUMBER OF SAMPLES ANALYZED	MUSCLE	42	7
	LIVER	40	7
	FAT	43	7
TOTAL ANALYZED		125	21

*INDUSTRIAL BIO-TEST LABORATORIES, INC.
NORTHBROOK, ILLINOIS

DSW 346897

TWO YEAR CHRONIC ORAL EXPOSURE RESIDUE STUDY OF AROCLOR 1242, AROCLOR 1254, AND AROCLOR 1260 IN BEAGLE DOGS

DSW 346898

STLCOPCB4084871

RESIDUE STUDY OF AROCLOR 1242 IN BEAGLE DOGS

TWO YEAR CHRONIC ORAL EXPOSURE

	PPM PCBs			HOMOLOG DISTRIBUTION									
				1	2	3	4	5	6	7	8	9	10
ORAL EXPOSURE LEVEL	1	10	100										
*RESIDUE, IF TOTAL FED RETAINED	519	5186	51865	-	(2)	(3)	(4)	(5)	6	-	-	-	-
*RESIDUE, 2 YEAR EXPOSURE	2	6	12	-	-	(3)	(4)	5	6	(7)	(8)	-	-
*RESIDUE, 30 DAY RECOVERY	1	4	10	-	-	-	-	5	(6)	(7)	(8)	-	-
*RESIDUE, 60 DAY RECOVERY	0.8	3	6	-	-	-	-	5	6	(7)	(8)	-	-

*AVERAGE PPM IN LIPID - ALL TISSUES

( )ELECTRON CAPTURE PEAKS GREATER THAN 5% OF TOTAL

DSW 346899

STLCOPCB4084872

RESIDUE STUDY OF AROCLOR 1254 IN BEAGLE DOGS

TWO YEAR CHRONIC ORAL EXPOSURE

	PPM PCBs			HOMOLOG DISTRIBUTION									
				1	2	3	4	5	6	7	8	9	10
ORAL EXPOSURE LEVEL	1	10	100										
*RESIDUE, IF TOTAL FED RETAINED	519	5186	51865	-	-	3	(4)	(5)	(6)	7	-	-	-
*RESIDUE, 2 YEAR EXPOSURE	7	30	132	-	-	-	-	(5)	(6)	(7)	8	-	-
*RESIDUE, 30 DAY RECOVERY	5	24	109	-	-	-	-	5	(6)	(7)	8	-	-
*RESIDUE, 60 DAY RECOVERY	4	20	88	-	-	-	-	5	(6)	(7)	(8)	-	-

*AVERAGE PPM IN LIPID - ALL TISSUES

( )ELECTRON CAPTURE PEAKS GREATER THAN 5% OF TOTAL

DSW 346900

STLCOPCB4084873

RESIDUE STUDY OF AROCLOR 1260 IN BEAGLE DOGS

TWO YEAR CHRONIC ORAL EXPOSURE

	PPM PCBs			HOMOLOG DISTRIBUTION									
				1	2	3	4	5	6	7	8	9	10
ORAL EXPOSURE LEVEL	1	10	100										
*RESIDUE, IF TOTAL FED RETAINED	519	5186	51865	-	-	-	-	(5)	(6)	(7)	8	-	-
*RESIDUE, 2 YEAR EXPOSURE	8	63	388	-	-	-	-	-	(6)	7	(8)	-	-
*RESIDUE, 30 DAY RECOVERY	7	60	363	-	-	-	-	-	(6)	(7)	(8)	-	-
*RESIDUE, 60 DAY RECOVERY	7	55	337	-	-	-	-	-	6	(7)	(8)	-	-

*AVERAGE PPM IN LIPID - ALL TISSUES

( )ELECTRON CAPTURE PEAKS GREATER THAN 5% OF TOTAL

DSW 346901

STLCOPCB4084874

GENERAL CONCLUSIONS

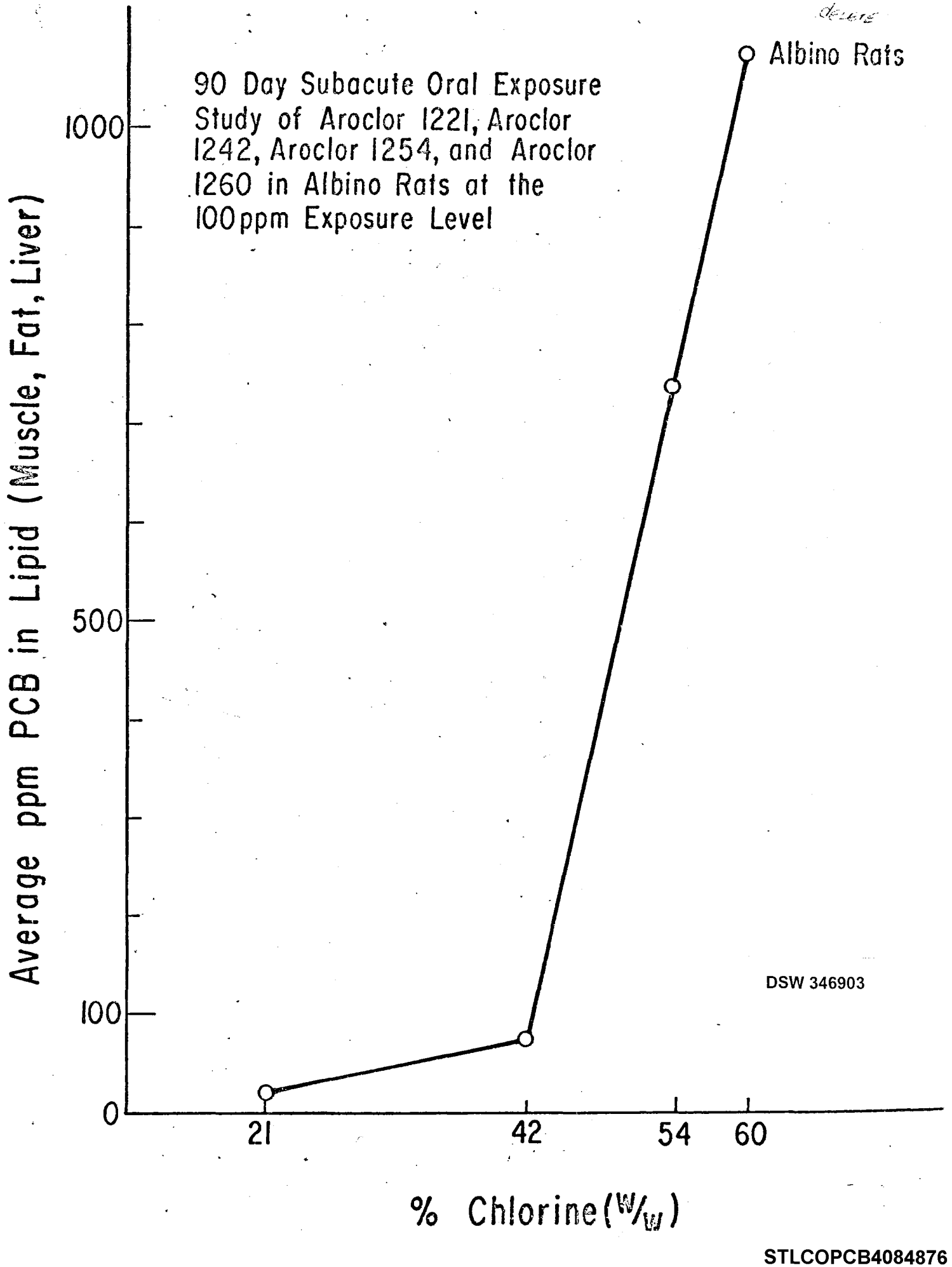
I. RESIDUE BUILDUP RATE

- INCREASED AS THE EXPOSURE LEVEL INCREASED
- INCREASED AS THE EXPOSURE PERIOD INCREASED
- DECREASED EXPONENTIALLY AS THE DEGREE OF CHLORINATION OF THE PRODUCT FED DECREASED
- AROCLOR 1260>AROCLOR 1254>>AROCLOR 1242 >AROCLOR 1221
- FISH>>>>>>CHICKENS>RATS>DOGS
- CHICKENS (LIPID): FAT = MUSCLE>LIVER

  RATS (LIPID): LIVER>FAT = MUSCLE>KIDNEY

  DOGS (LIPID): LIVER>FAT = MUSCLE

DSW 346902



STLCOPCB4084876

GENERAL CONCLUSIONS

I. RESIDUE BUILDUP RATE

- INCREASED AS THE EXPOSURE LEVEL INCREASED
- INCREASED AS THE EXPOSURE PERIOD INCREASED
- DECREASED EXPONENTIALLY AS THE DEGREE OF CHLORINATION OF THE PRODUCT FED DECREASED
- AROCLOR 1260>AROCLOR 1254>>AROCLOR 1242 >AROCLOR 1221
- FISH>>>>>>CHICKENS>RATS>DOGS
- CHICKENS (LIPID): FAT = MUSCLE>LIVER

  RATS (LIPID): LIVER>FAT = MUSCLE>KIDNEY

  DOGS (LIPID): LIVER>FAT = MUSCLE

DSW 346904

	EXPOSURE LEVEL (PPM)	EXPOSURE PERIOD	CONCENTRATION FACTOR*
BLUEGILLS	0.1 (WATER)	21 DAYS	400,000
CATFISH	0.1 (WATER)	21 DAYS	320,000
WHITE LEGHORN CHICKENS	1.0 (FEED)	12 WEEKS	20
ALBINO RATS	1.0 (FEED)	2 YEARS	9
BEAGLE DOGS	1.0 (FEED)	2 YEARS	2

*CONCENTRATION FACTORS DO NOT TAKE INTO ACCOUNT EXPOSURE PERIODS

DSW 346905

GENERAL CONCLUSIONS

I. RESIDUE BUILDUP RATE

- INCREASED AS THE EXPOSURE LEVEL INCREASED
- INCREASED AS THE EXPOSURE PERIOD INCREASED
- DECREASED EXPONENTIALLY AS THE DEGREE OF CHLORINATION OF THE PRODUCT FED DECREASED
- AROCLOR 1260>AROCLOR 1254>>AROCLOR 1242 >AROCLOR 1221
- FISH>>>>>>CHICKENS>RATS>DOGS
- CHICKENS (LIPID): FAT = MUSCLE>LIVER

  RATS (LIPID): LIVER>FAT = MUSCLE>KIDNEY

  DOGS (LIPID): LIVER>FAT = MUSCLE

DSW 346906

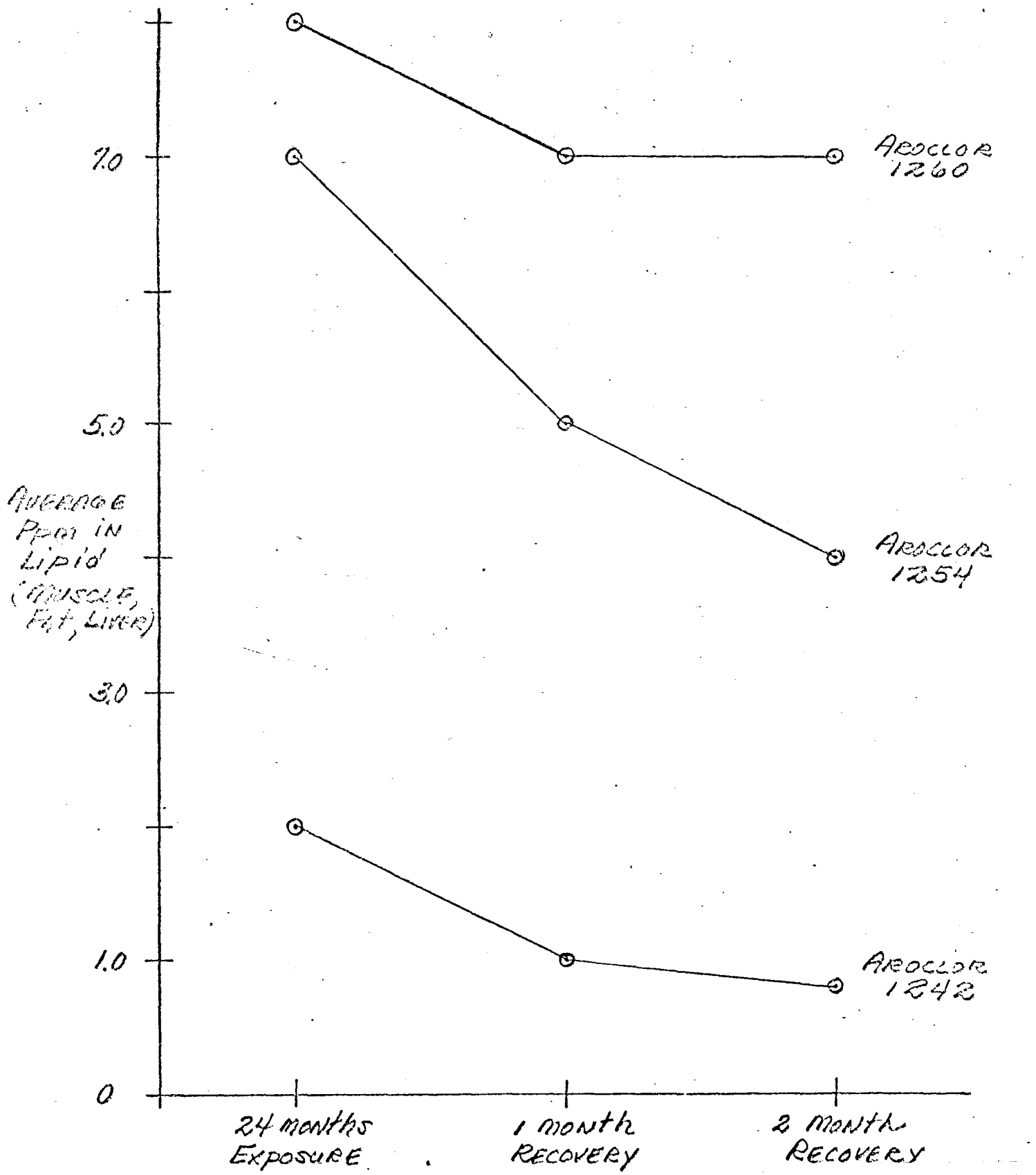
GENERAL CONCLUSIONS

II. RESIDUE FALL OFF RATE

- INCREASED AS THE EXPOSURE LEVEL DECREASED
- INCREASED AS THE DEGREE OF CHLORINATION OF THE PRODUCT FED DECREASED
- AROCLOR 1242>AROCLOR 1254>AROCLOR 1260
- INCREASED AS RECOVERY PERIOD INCREASED
- DOGS>CHICKENS

DSW 346907

Two Year Chronic Oral Exposure in Beagle Dogs at the 1 Ppm Level



DSW 346908

GENERAL CONCLUSIONS

II. RESIDUE FALL OFF RATE

- INCREASED AS THE EXPOSURE LEVEL DECREASED
- INCREASED AS THE DEGREE OF CHLORINATION OF THE PRODUCT FED DECREASED
- AROCLOR 1242>AROCLOR 1254>AROCLOR 1260
- INCREASED AS RECOVERY PERIOD INCREASED
- DOGS>CHICKENS

DSW 346909

STLCOPCB4084882

GENERAL CONCLUSIONS

III. ALTERATION OF THE HOMOLOG DISTRIBUTION OF PRODUCTS FED

- INDEPENDENT OF EXPOSURE LEVEL
- INDEPENDENT OF EXPOSURE PERIOD
- HIGHER CHLORINATED HOMOLOGS DOMINANTLY RETAINED (PENTA-, HEXA-, HEPTA-, OCTA-CHLORO BIPHENYLS)
- DOGS>RATS>CHICKENS>>>>>FISH*
- INCREASED AS DEGREE OF CHLORINATION OF PRODUCT FED DECREASED

  AROCLOR 1221>AROCLOR 1242>AROCLOR 1254 >AROCLOR 1260

*DISTRIBUTION UNALTERED BY FISH

DSW 346910

INFORMATION AVAILABLE TO TASK-FORCE

1. WESTINGHOUSE REPORT (see excerpts)

   a. %-composition of Aroclor 1221/1242 in detail
      MCS 1016
      MCS 1043
      Approx. composition of 1232/1248/1254/1260

      Compositions do not agree with present MICC data. We do not want to produce MCS 1043.

   b. Electrical and physical properties of Aroclor 1242/1016/1043 compared to mineral oil.

   c. Biodegradability including MCS 1043 and 1016

      - more comprehensive than what we intend to submit May 15.

2. N.I.P.C.C. REPORT (Composite of G.E./Westinghouse reports)

   (See Excerpts)

   a. Compositions as per Westinghouse.

   b. Phys. properties - same products as Westinghouse report but different values.

   c. No biodegradation data in N.I.P.C.C. report.

3. GENERAL ELECTRIC REPORT (See Excerpts)

   a. Composition - not nearly as detailed as Westinghouse/N.I.P.C.C. reports. Mentions Aroclor MCS 1016 "essentially Aroclor 1242 that has been specially processed to reduce the content of pentachlorobiphenyls and higher to less than 0.4%".

DSW 346911

STLCOPCB4084884