

ASSESSMENT OF THE PERSISTENCE OF
POLYCHLORINATED BIPHENYLS
IN BIOLOGICAL SYSTEMS



NEV 026032

% COMPOSITION OF POLYCHLORINATED BIPHENYL PRODUCTS*

<u>HOMOLOG</u> <u># C1/BIPHENYL</u>	<u>AROCLOR</u> <u>1221</u>	<u>AROCLOR</u> <u>1016</u>	<u>AROCLOR</u> <u>1242</u>	<u>AROCLOR</u> <u>1254</u>
0	10.8	-	-	-
1	51.0	1.0	0.7	-
2	32.0	19.4	15.6	0.2
3	4.2	64.5	54.5	0.6
4	1.6	15.0	22.5	23.0
5+	0.3	0.2	6.7	77.2

*PER CENT (W/W) BY GC/MASS

*Should we
show A.1260 ?*

026033

Electron Capture Gas Chromatograms

Aroclor 1221

Aroclor 1242

Aroclor 1254

Aroclor 1260

0 5 10 15 20 25 30

Elution Time (minutes)

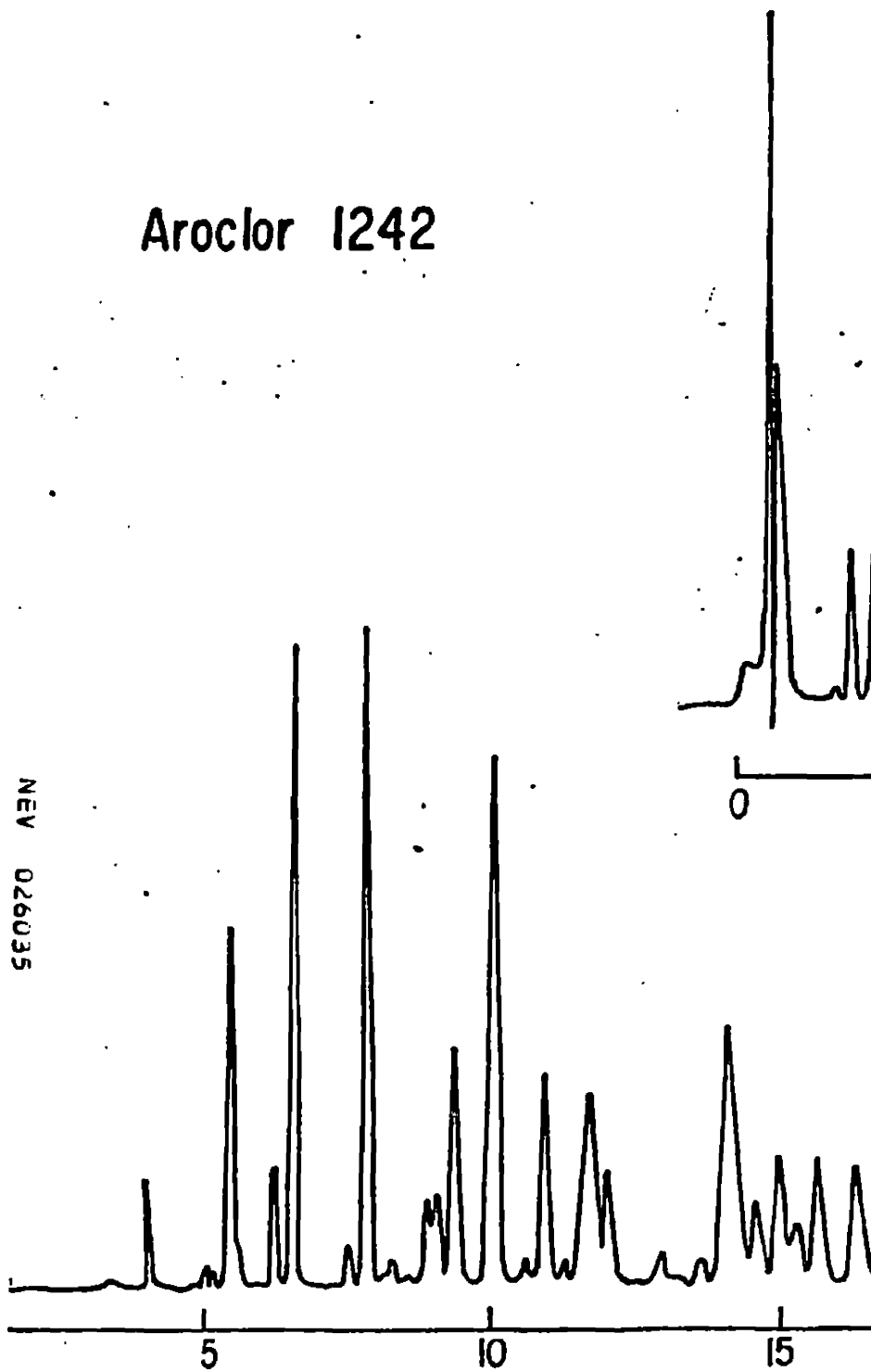
NEV 026034

739289

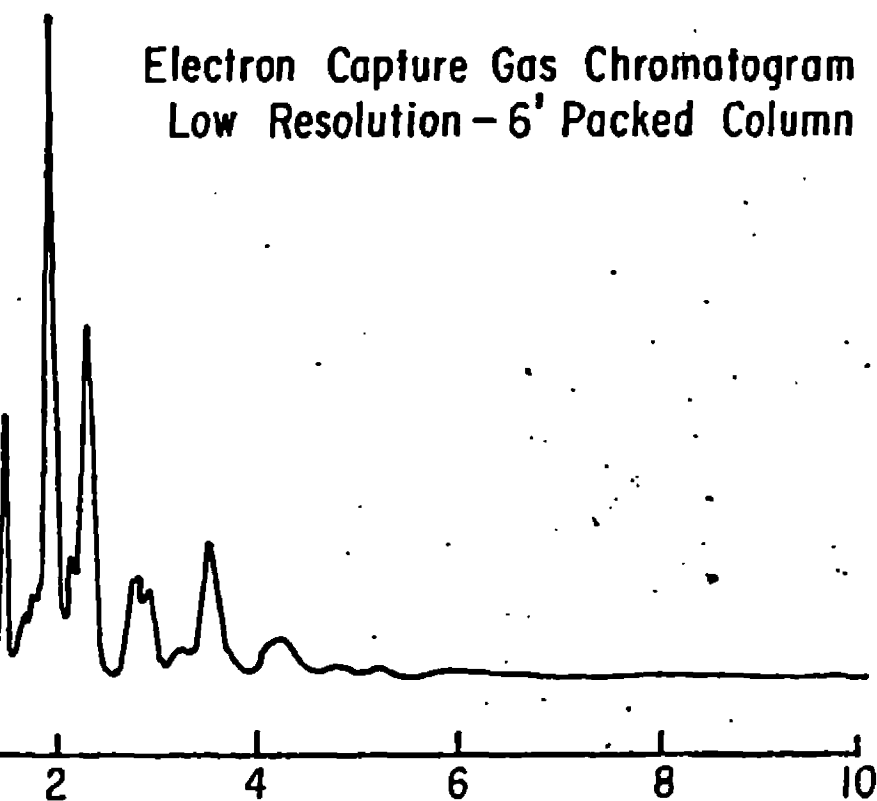
Aroclor 1242

NEV 026035

739290

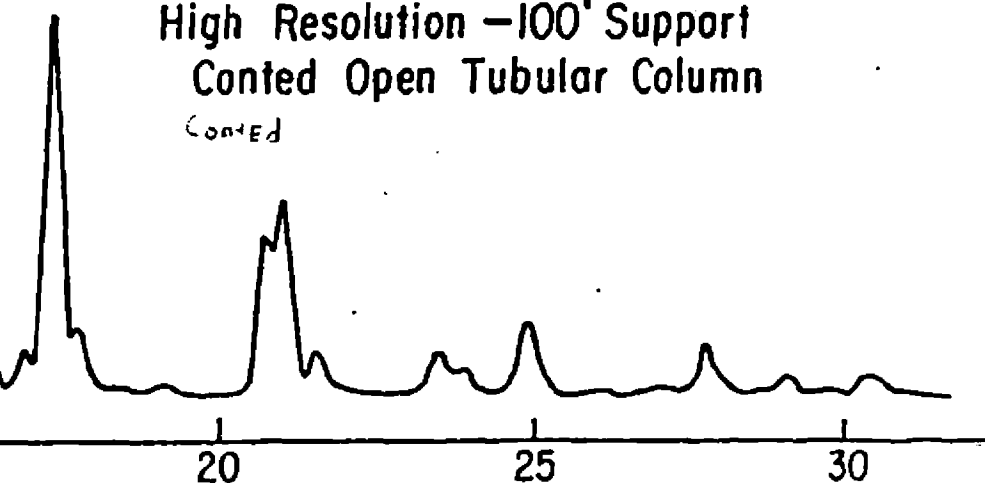


Electron Capture Gas Chromatogram
Low Resolution - 6' Packed Column



Flame Ionization Gas Chromatogram
High Resolution - 100' Support
Coated Open Tubular Column

Cont'd



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

NEV 026036

AROCLOR SEMI-CONTINUOUS ACTIVATED

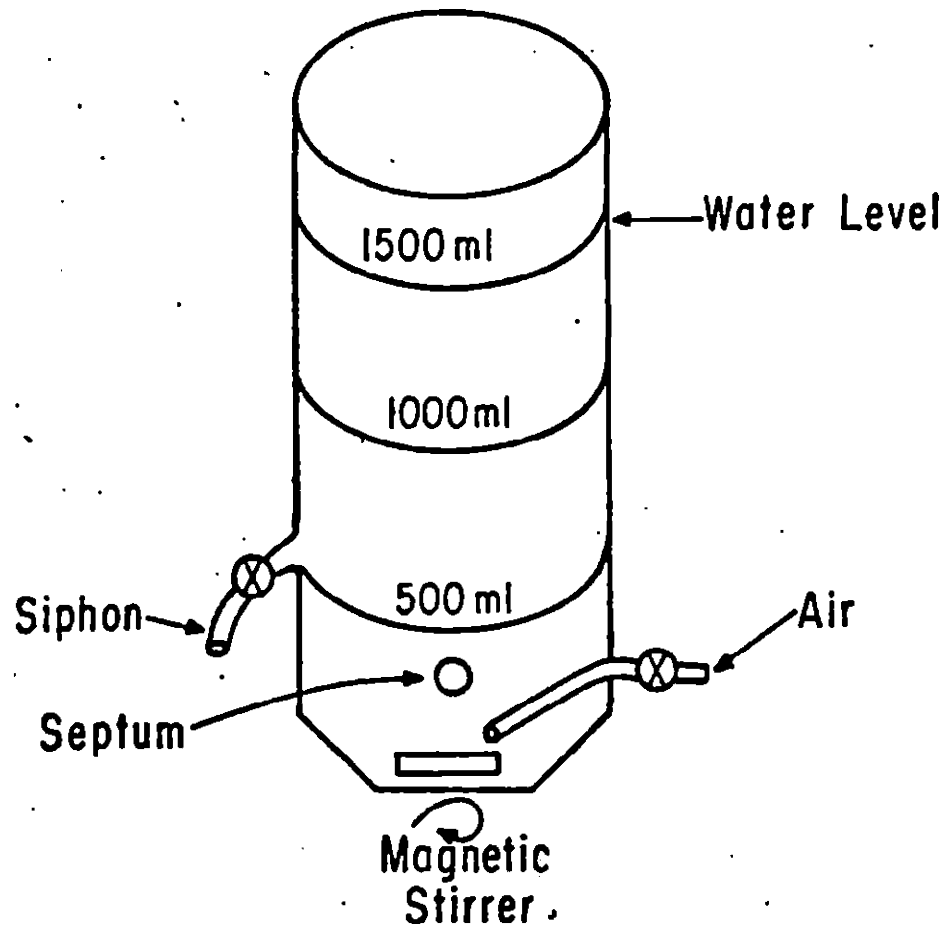
SLUDGE PRIMARY DEGRADATION STUDIES

NEV 026037

739292

Activated

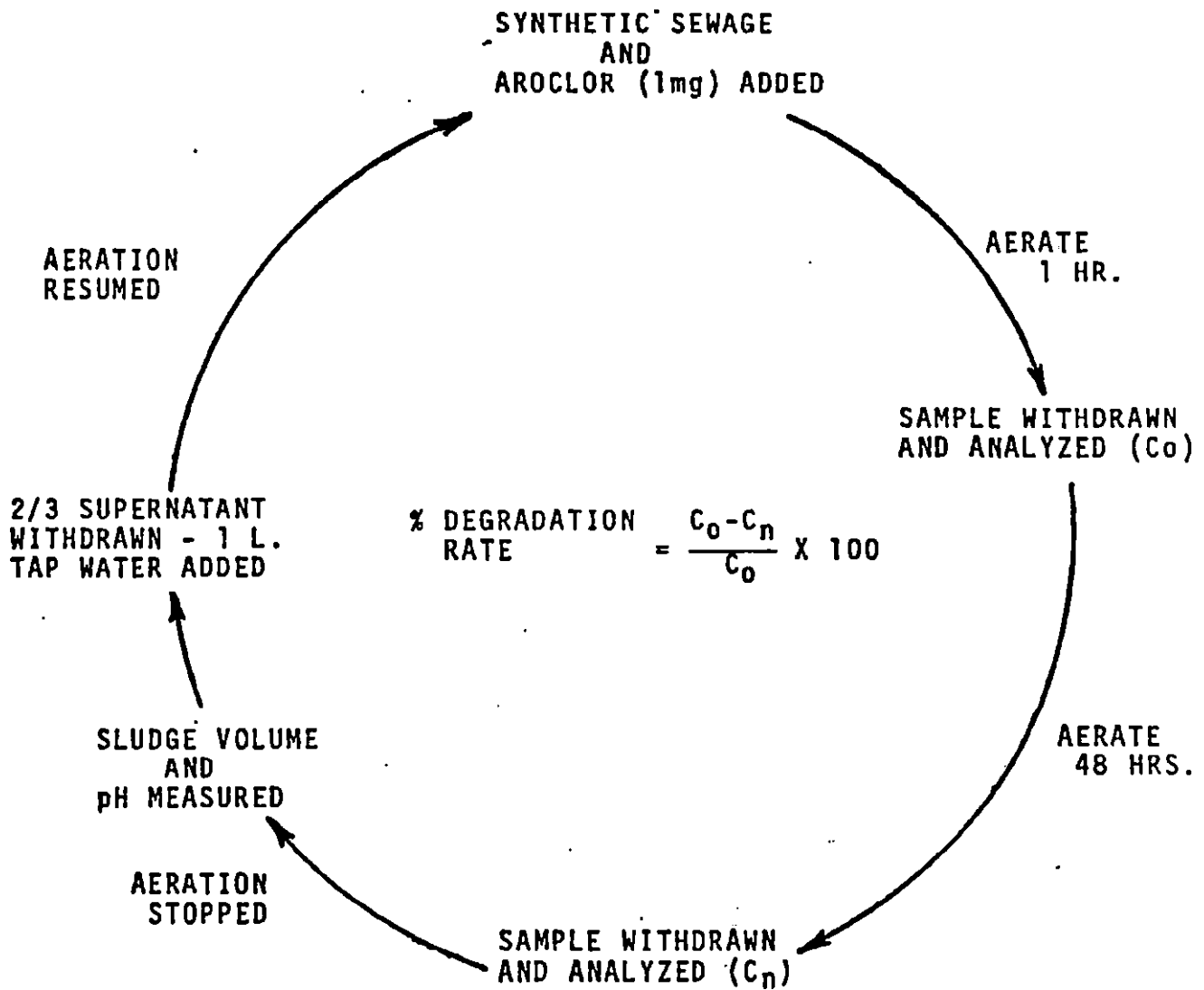
Semi-Continuous Activated Sludge Test Unit



NEV 026038

739293

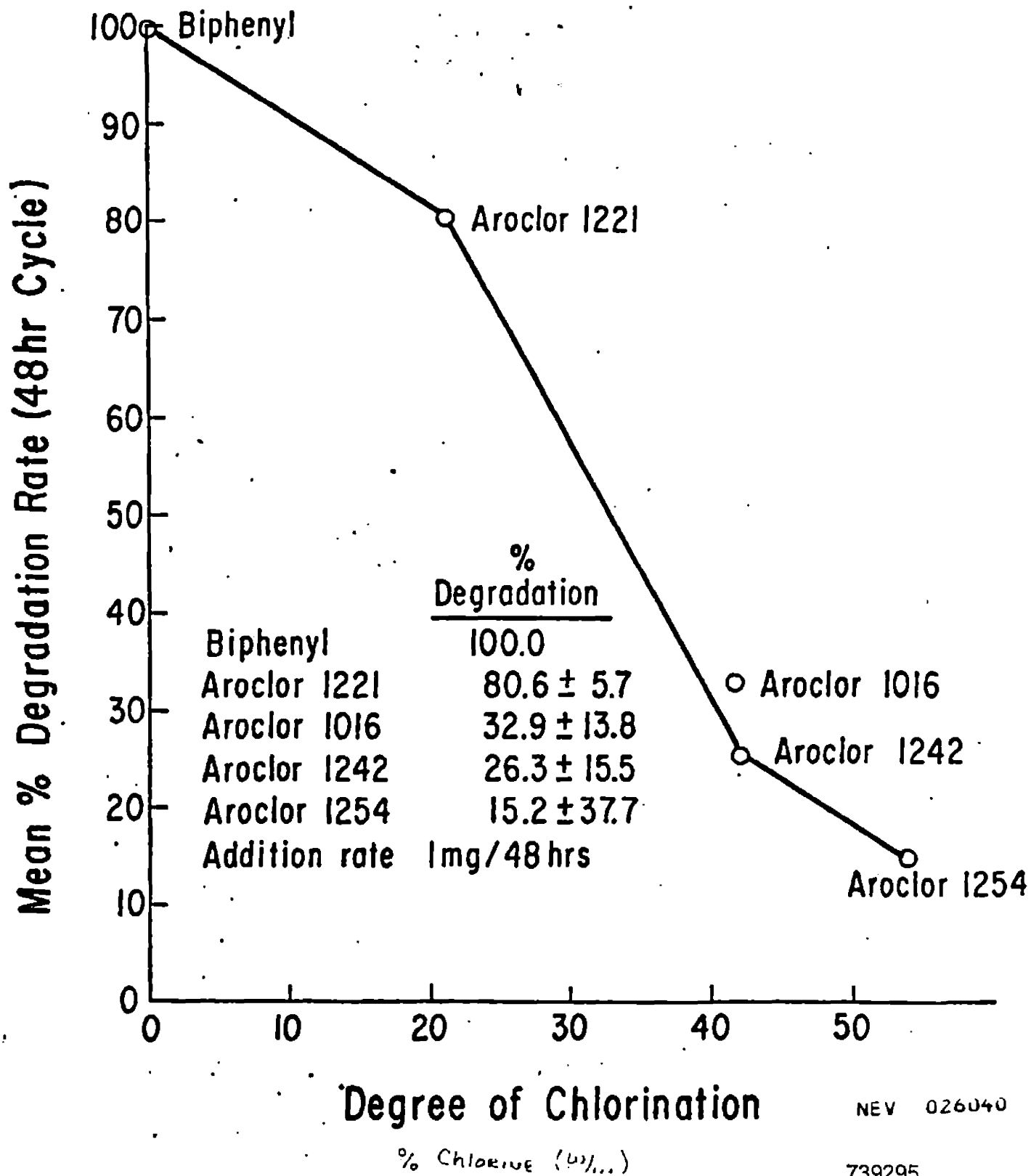
MECHANICAL CYCLE



NEV 026039

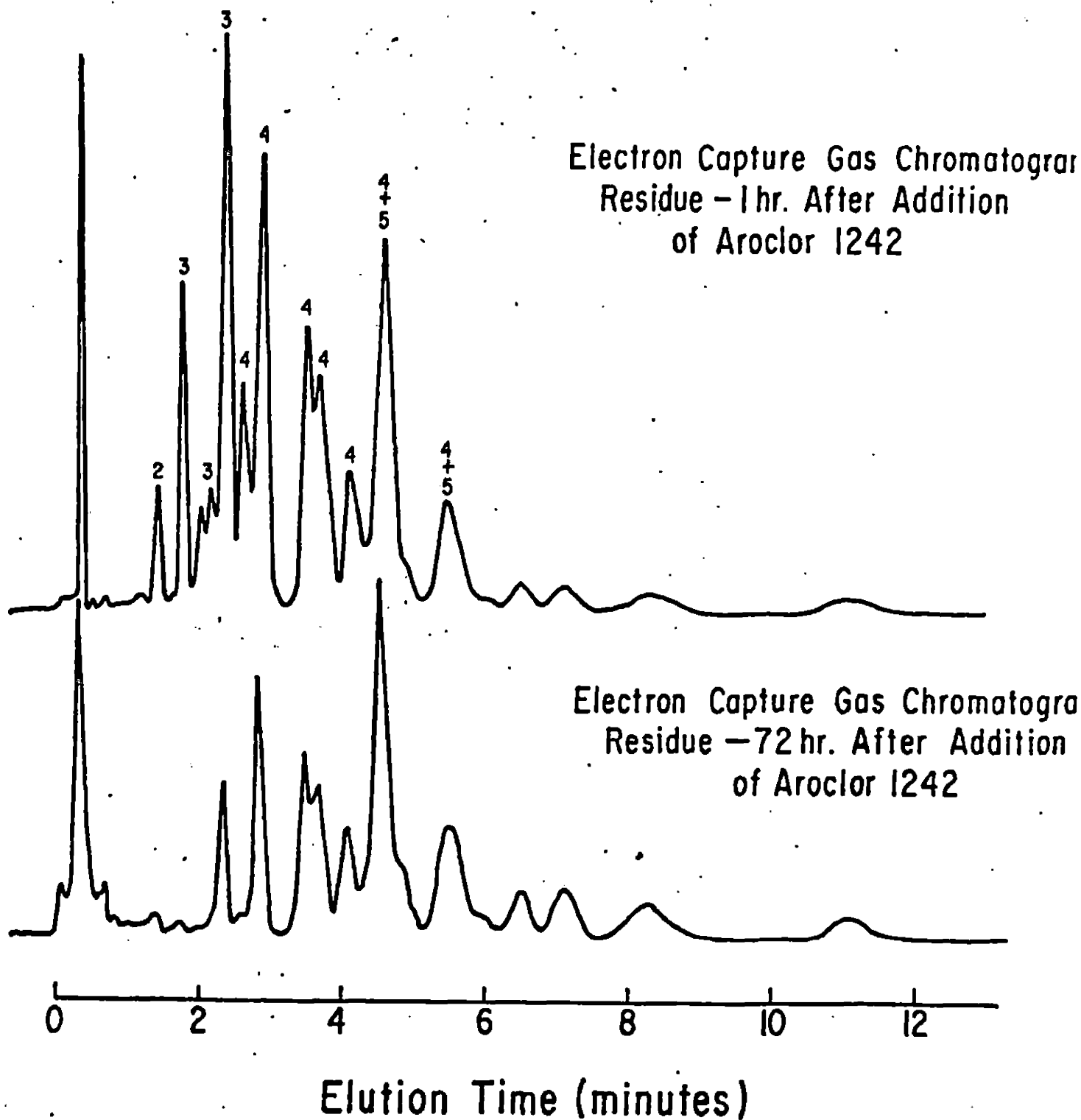
739294

Semi-Continuous Activated Sludge Degradation of Polychlorinated Biphenyls



Activated.

Semi-Continuous Activitated Sludge Degradation of Aroclor 1242



NEV 026041

739296

CONCLUSIONS

- 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

NEV 026042

739297

AROCLOR RESIDUE STUDIES

NEV 026043

739298

RESIDUE STUDIES* - CATFISH AND BLUEGILL
FINGERLINGS

21 DAY DYNAMIC

<u>PRODUCTS STUDIED</u>	<u>AROCLOR 1016</u> <u>AROCLOR 1242</u>
NUMBER OF FISH	270
NUMBER OF SAMPLES WHOLE FISH	24
NUMBER OF SAMPLES ANALYZED WHOLE FISH	24

*BIONOMICS, INC.
WAREHAM, MASSACHUSETTS

NEV 026044

739299

RESIDUE STUDIES* - BEAGLE DOGS

SAMPLES.

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

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

FEED LEVELS : 1, 10, 100 ppm.

NEV 026045

739300

RESIDUE STUDIES* - ALBINO RATS

SAMPLES .

PRODUCTS STUDIED		30 DAY ORAL	2 YEAR CHRONIC ORAL	3 GENERATION RAT REPRODUCTION	90 DAY SUBACUTE ORAL
		AROCLOR 1242	AROCLOR 1242	AROCLOR 1242	
		AROCLOR 1254	AROCLOR 1254	AROCLOR 1254	
		AROCLOR 1260	AROCLOR 1260	AROCLOR 1260	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

FEED LEVELS : 1, 10, 100 ppm.

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

NEV 026046

739301

RESIDUE STUDIES* - WHITE LEGHORN CHICKENS

Samples.

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

NEV 026047

739302

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

NEV 026048

739303

RESIDUE STUDY OF AROCLOR 1242 IN BEAGLE DOGS

TWO YEAR CHRONIC ORAL EXPOSURE

NEW 026049

ORAL EXPOSURE LEVEL	PPM PCBs			HOMOLOG DISTRIBUTION									
	1	10	100	1	2	3	4	5	6	7	8	9	10
*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)	-	-

explanation? Conc. effect?

*AVERAGE PPM IN LIPID - ALL TISSUES

() ELECTRON CAPTURE PEAKS GREATER THAN 5% OF TOTAL

739304

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

739305

NEW 026050

RESIDUE STUDY OF AROCLOR 1260 IN BEAGLE DOGS

TWO YEAR CHRONIC ORAL EXPOSURE

ORAL EXPOSURE LEVEL	PPM PCBs			HOMOLOG DISTRIBUTION									
				1	2	3	4	5	6	7	8	9	10
	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

739306

NEW 026051

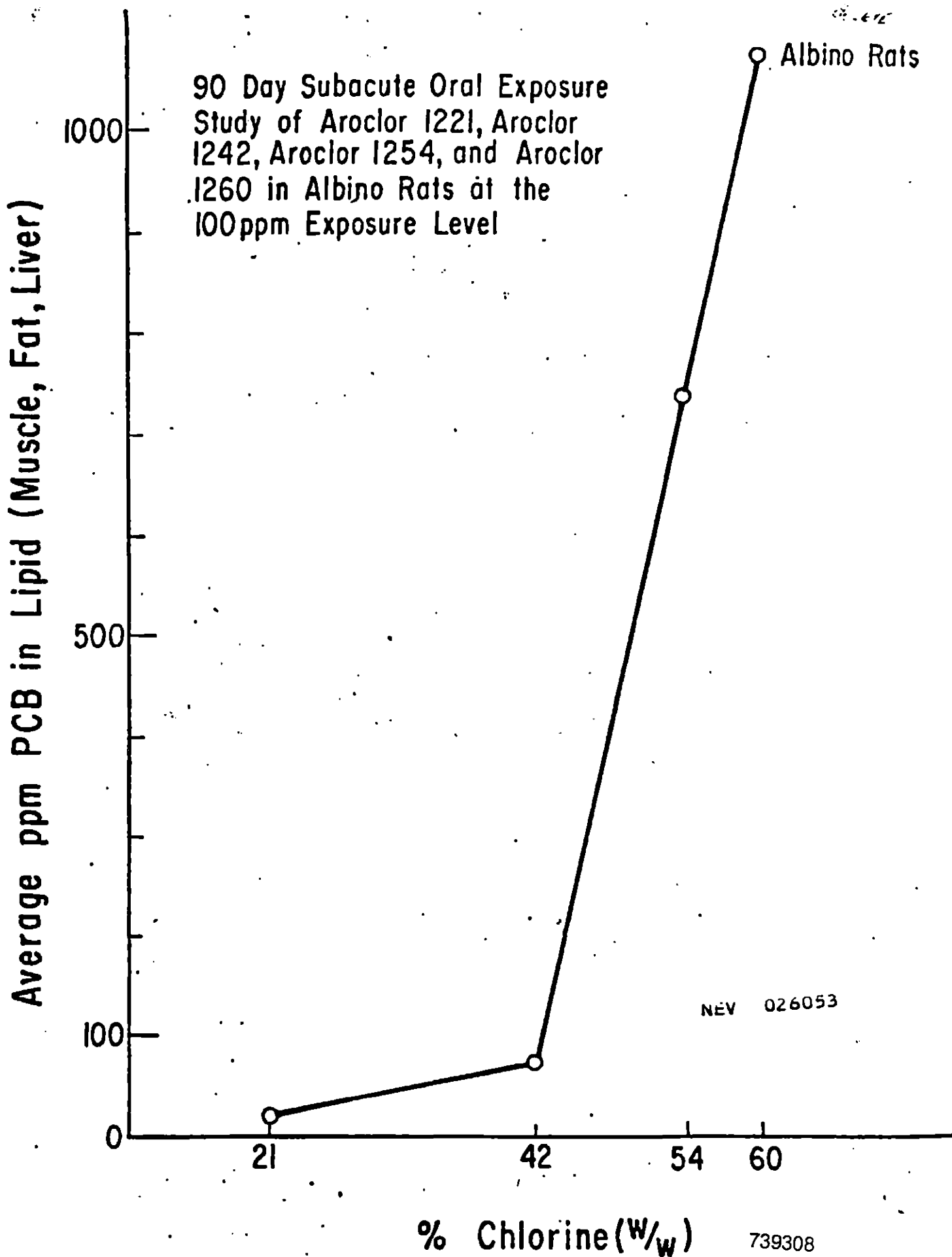
GENERAL CONCLUSIONS

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

NEV 026052

739307



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

NEV 026054

	<u>EXPOSURE LEVEL (PPM)</u>	<u>EXPOSURE PERIOD</u>	<u>CONCENTRATION FACTOR*</u>
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

NEV 026055

739310

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

NEV 026056

739311

GENERAL CONCLUSIONS

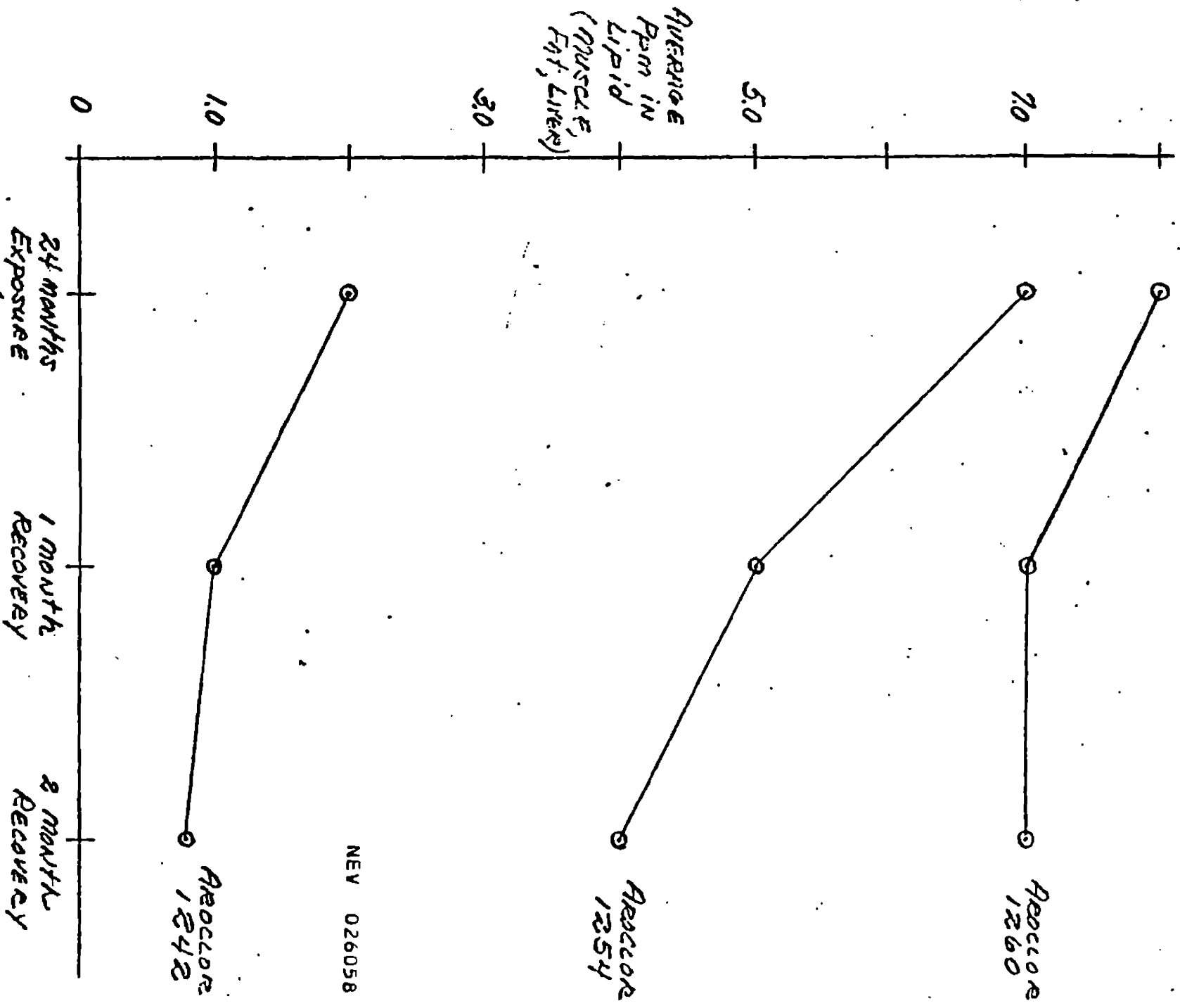
II. RESIDUE FALL OFF RATE .

- . 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

NEV 026057

739312

TWO YEAR CHRONIC DEAR EXPOSURE IN BEAGLE DOGS AT THE 1 PPM LEVEL



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

NEV 026059

739314

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

NEV 026060

739315

RESIDUE STUDY OF AROCLOR 1242 IN WHITE LEGHORN CHICKENS

NEW 026061

	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	126	1260	12602	-	(2)	(3)	(4)	(5)	6	-	-	-	-
RESIDUE, 12 WEEK EXPOSURE	14	136	1312	-	-	(3)	(4)	(5)	6	-	-	-	-
RESIDUE, 30 DAY RECOVERY	9	77	749	-	-	(3)	(4)	(5)	(6)	-	-	-	-

*AVERAGE PPM IN LIPID - ALL TISSUES

() ELECTRON CAPTURE PEAKS GREATER THAN 5% OF TOTAL

739316

RESIDUE STUDY OF AROCLOR 1254 ... WHITE LEGHORN CHICKENS

NEW 026062

	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	126	1260	12602	-	-	3	(4)	(5)	(6)	7	-	-	-
RESIDUE, 12 WEEK EXPOSURE	38	362	3506	-	-	-	4	(5)	(6)	7	-	-	-
RESIDUE, 30 DAY RECOVERY	17	164	1580	-	-	-	-	5	(6)	7	-	-	-

*AVERAGE PPM IN LIPID - ALL TISSUES

() ELECTRON CAPTURE PEAKS GREATER THAN 5% OF TOTAL

739317