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Final Report

Project Order No. T-9035B

A Study of the Biological Effect of Continuous Inhalation Exposure of 1, 1, 1-Trichloroethane (Methyl Chloroform) on Animals

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Studies were conducted to evaluate the effects of continuous exposure to 1, 1, 1-trichloroethane on hepatic morphology and function and to compare these effects with those produced by methylene chloride (dichloromethane) in a previous study. The primary aspect of comparison was to determine environmental concentrations of each compound that would produce a similar biological response, i.e., a comparable increase in liver triglycerides over control levels.

A preliminary 14-day test was conducted using mice only, to establish exposure concentrations for the 100-day continuous exposures. In the preliminary test mice were exposed to 100 and 250 ppm and serially sacrificed at 3, 7, 10 and 14 days for liver triglyceride determinations and tissue stains for fat deposition. The mice exposed to the highest concentration of 1, 1, 1-trichloroethane (TCE) showed no significant liver triglyceride changes while an occasional animal showed increased hepatic fat accumulation after 14 days exposure. We therefore, selected 250 and 1000 ppm TCE as our exposure concentrations for the 100-day continuous exposure study.

Methodology

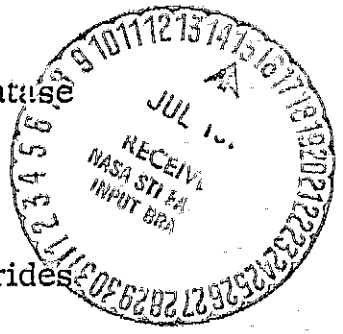
Groups of 4 monkeys, 180 mice, 8 dogs and 40 rats each were housed in Thomas Domes. The three groups of animals were exposed to 250 ppm TCE, 1000 ppm TCE and clean air respectively. The clean air exposed animals served as controls for the test animals.

Ten mice were removed from each group on a weekly basis for gross examination, liver fat stains and liver triglyceride determinations. Rats, dogs, and monkeys were weighed on a biweekly schedule for evaluation of growth patterns. The rats were sacrificed at the end of the exposure period for organ weight measurement, liver fat stains and complete histopathologic evaluation.

Blood samples were collected from dogs and monkeys at the time of weighing and the following determinations made:

Clinical Test Schedule, Biweekly - Duration of Study

HCT	Albumin/Globulin
HGB	Total Protein
RBC	BUN
WBC	Glucose
Reticulocyte Count	Alkaline Phosphatase
Sodium	SGOT
Potassium	Creatinine
Cholesterol	Chloride
Calcium	SGPT
Inorganic Phosphorus	Serum Triglycerides
Total Bilirubin	



Since dichloromethane had been shown to be partially metabolized to carbon monoxide, carboxyhemoglobin measurements were made on samples taken after 2 weeks exposure. Blood levels of TCE were determined during the third, fifth, ninth and thirteenth weeks of exposure.

The exposures were completed on November 12, 1973 and final animal weights and blood samples were measured at that time except for 2 sets of mice from each experimental group that were examined at 2 and 4 weeks postexposure to determine reversibility of any measured effects. Tissue samples were harvested for histopathologic examination and fat stains of frozen liver sections taken at weekly intervals.

Results

Continuous exposure of mice to 1000 ppm TCE produced a significant increase in fat droplets which were evident in centrolobular hepatocytes. A slight increase was also seen at the 250 ppm TCE concentration while control mice showed very little fat accumulation. A semiquantitative measurement of fat accumulation was made on individual mouse liver sections stained with oil red "O" and the mean values are presented in Table 1. There was no evidence of hepatocyte necrosis, inflamation or fibrosis in any of the mouse livers examined. In mice, almost all fatty change was microglobular and was in a centrilobular distribution while in monkeys, the majority of the fat was in Kupffer cells and only a trace of microglobular fat was present in hepatocytes of all groups, control and exposed. Minimal microglobular fat was present in rather diffuse distribution in both the rats and dogs and was similar in both exposed and control groups.

TABLE 1. A SEMIQUANTITATIVE MEASURE OF FAT ACCUMULATION IN MOUSE LIVER AFTER 100 DAYS CONTINUOUS INHALATION EXPOSURE TO 1,1,1-TRICHLOROETHANE

(Mean values, 3 mice per group)

Week of Exposure	Scale Value 1 to 5+		
	Control	250 ppm	1000 ppm
1	0.7	1.7	2.0
2	0.5	0.8	2.3
3	0.3	0.5	1.7
4	0.0	1.0	2.3
5	0.0	0.2	2.0
6	0.2	0.8	1.7
7	0.3	0.3	2.7
8	0.3	0.5	1.3
9	0.3	0.8	1.7
10	0.2	0.5	1.7
11	0.2	0.3	1.0
12	0.2	0.0	1.0
13	0.0	0.5	0.8
14	0.5	0.5	1.0
Postexposure			
2	0.2	0.2	0.3
4	0.0	0.2	0.0

Scale Criteria	Description
1+	Fatty change, marked, up to 5 cell diameters from border of central vein.
2+	Fatty change, marked, up to 10 cell diameters from border of central vein.
3+	Fatty change, marked, greater than 10 cell diameters from central vein with many confluent areas and some tendency for macroglobular fat.

Mouse liver weights and liver to body weight ratios are shown in Table 2. There was little if any real effect at the 250 ppm exposure level but a consistent and statistically significant increase in liver to body weight ratios was seen in the 1000 ppm TCE exposure group of mice. Variation of liver triglyceride values from mouse control values in the 250 ppm TCE exposure group was spotty but was highly significant at 1000 ppm. The increase in liver triglycerides at 1000 ppm TCE was relatively constant throughout the exposure period.

After 2 weeks postexposure the liver to body weight ratios were no longer different from control values indicating the observed fatty liver change was a reversible effect as was also observed in fat stains of hepatic tissue.

Rat growth rates were identical in the control and 250 ppm TCE exposed group, and the growth of the 1000 ppm TCE exposed rats was not significantly different, although the group mean was approximately 10 grams lower from the 6th week on. Growth rates for three rat groups are depicted in Figure 1. Rat liver to body weight ratios were also significantly increased at the 1000 ppm exposure level but the 250 ppm exposure group was similar to control animals.

Carboxyhemoglobin levels were measured in dogs and monkeys after 2 weeks exposure. The measured values were identical in control and test animals as shown in Table 3.

TABLE 2. THE EFFECT OF 100 DAY CONTINUOUS INHALATION EXPOSURE TO 1,1,1-TRICHLOROETHANE ON MOUSE LIVER

Week of Exposure	Liver Weights, Gms.			Liver/Body Wt. Ratio			Liver Triglyceride mg/g		
	Control	250 ppm	1000 ppm	Control	250 ppm	1000 ppm	Control	250 ppm	1000 ppm
1	1.74	1.82	1.98	5.80	6.14	7.34**	4.01	6.04*	-
2	1.71	1.97*	2.38**	5.59	6.27*	8.05**	5.57	5.94	22.54**
3	1.94	1.98	2.15	5.68	5.83	6.98**	6.24	3.75*	29.66**
4	1.96	1.94	2.31**	5.88	5.84	7.50**	4.90	7.53**	29.47**
5	1.93	1.88	2.14	5.55	5.76	6.54*	7.53	7.33	38.77**
6	1.93	2.02	2.07	5.49	5.98	6.45**	6.90	9.50	20.80**
7	1.95	2.05	2.55**	5.57	5.92	7.42**	7.47	6.30	40.90**
8	1.84	2.22**	2.28	5.32	6.62**	7.07**	6.93	10.43	21.40*
9	2.01	2.26	2.60**	5.52	6.21*	7.72**	4.37	6.20	28.73*
10	2.10	2.16	2.26	5.72	6.21	7.06**	5.37	6.23	24.73**
11	2.43	2.29	2.50	6.05	6.17	7.26**	6.40	4.53	19.67*
12	2.05	2.20	2.78**	5.83	5.99	7.66**	3.87	3.93	18.33**
13	2.35	2.45	2.53	6.03	6.56	7.31**	3.93	6.30	12.50
14	2.28	2.34	2.46	5.89	6.24	7.20**	4.83	6.30	16.77**
Post-Exposure									
2	2.38	2.60	2.19	6.02	6.41	5.87	3.83	4.10	5.00
4	2.27	2.37	2.54	6.22	6.34	7.09	3.40	3.45	2.60

* Significant at the 0.05 level.
** Significant at the 0.01 level.

Figure 1

Effects of Continuous 1,1,1-Trichloroethane Exposure on Rat Growth

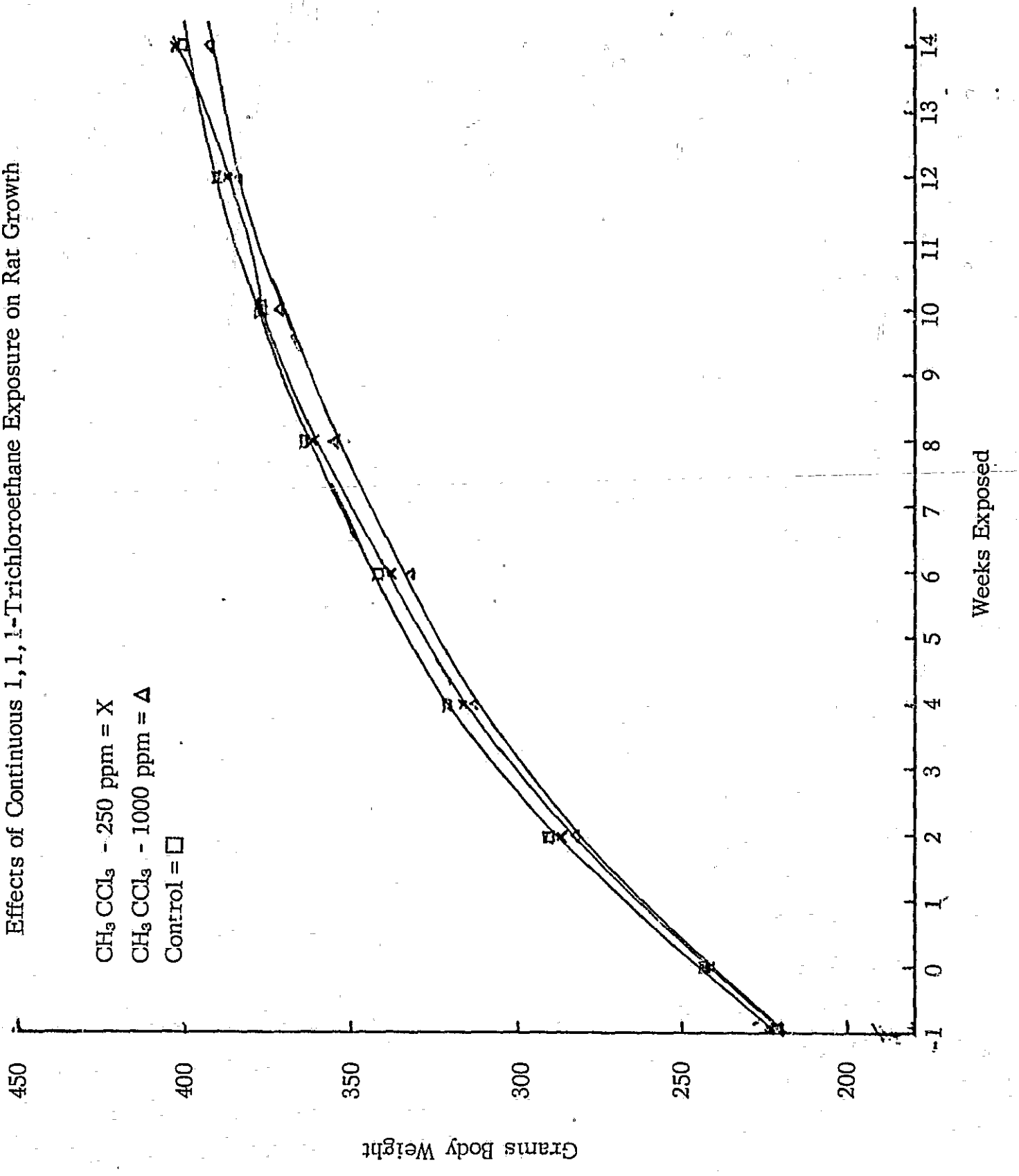


TABLE 3. MEAN CARBOXYHEMOGLOBIN CONCENTRATIONS IN DOGS AND MONKEYS EXPOSED TO 1,1,1-TRICHLOROETHANE (% COHb)

Exposure Level	Dogs	Monkeys
Control	0.6%	0.9%
250 ppm	0.6%	0.8%
1000 ppm	0.5%	*

*Sample Lost

The 1,1,1-trichloroethane levels in dog and monkey blood were variable from one sampling period to another but ranged from 4 to 6 times higher in the 1000 ppm TCE exposure group when compared with the 250 ppm group. The mean blood concentrations of unchanged 1,1,1-trichloroethane are shown in Table 4.

TABLE 4. 1,1,1-TRICHLOROETHANE CONCENTRATION IN BLOOD (μg/gram)

	Dogs Weeks				Monkeys Weeks			
Exposure Level	3	5	9	13	3	5	9	13
Control	0	0	0	0	0	0	0	0
250 ppm	11.3	16	9.2	17	4.0	14	3.2	4.4
1000 ppm	75	46	38	75	33	48	17	30

Although various clinical chemistry and hematology parameters flucuated occasionally there were no clinically significant differences between the control dogs and monkeys and their TCE exposed counterparts. The biweekly mean values for all clinical tests are graphically depicted in the Appendix.

Electron microscopy revealed that cytoplasmic alterations were most severe in centrilobular hepatocytes in the 1000 ppm group, and were mild to minimal in the 250 ppm group. These alterations consisted of vesiculation of the rough endoplasmic reticulum with loss of attached polyribosomes, increased smooth endoplasmic reticulum, microbodies and triglyceride droplets. Some cells had ballooned cisternae of the rough endoplasmic reticulum.

Focal hepatocyte necrosis peaked at the 12th week of exposure where it was present in 40% of the mice exposed to 1000 ppm TCE. This necrosis was associated with an acute inflammatory infiltrate and hypertrophy of Kupffer cells.

The most significant lesion in the rats was the presence of chronic respiratory disease (CRD) which was found in 12 of 40 controls, 28 of 40 rats in the 250 ppm group, and in 17 of 40 rats exposed to 1000 ppm TCE.

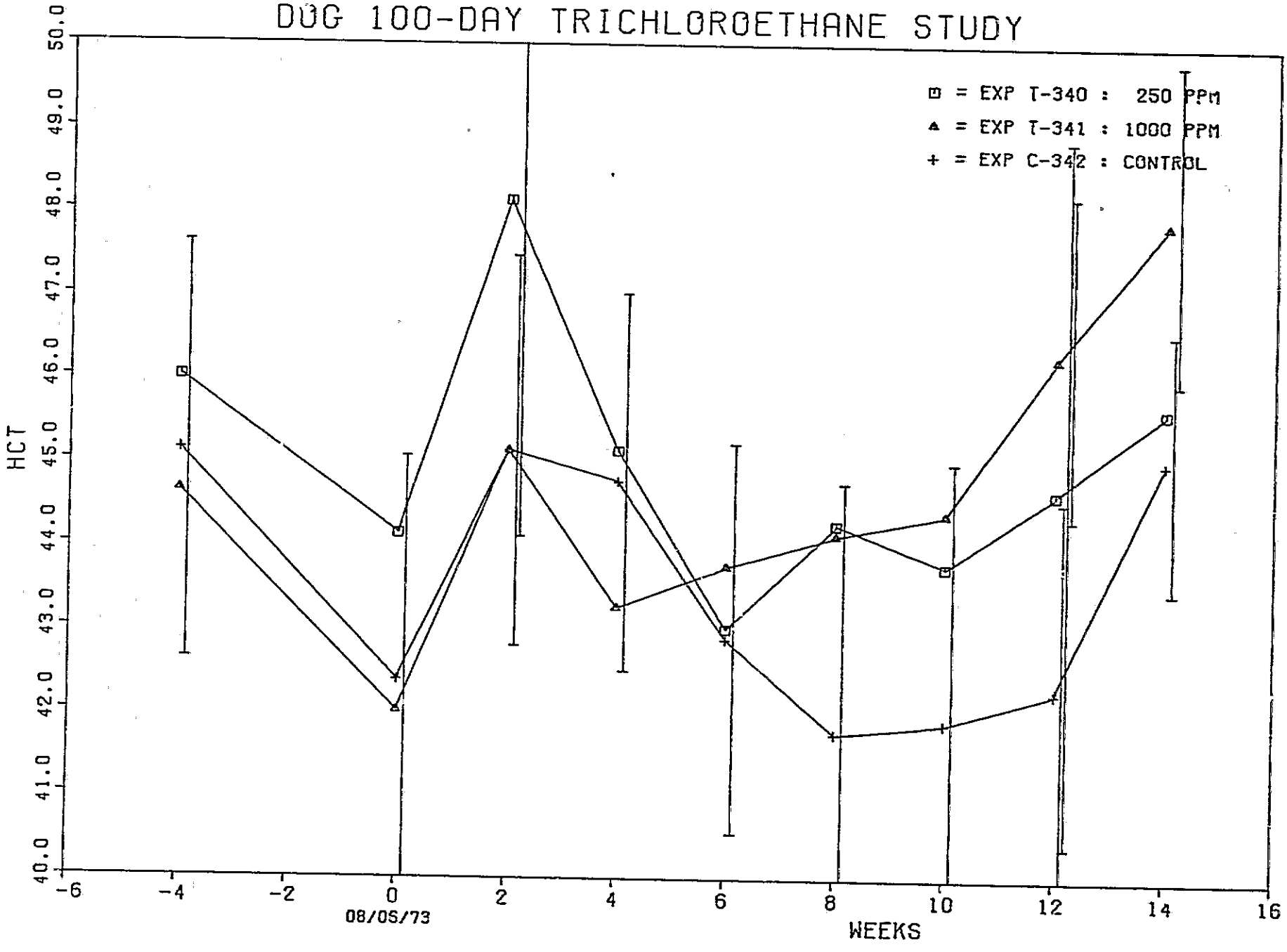
The only other lesion of consequence was the presence of focal areas of tubular dilatation in the kidney. Since this was found at approximately the same incidence in the controls and experimentals (19 of 40 controls, 22 of 40 rats exposed to 250 ppm, and 21 of 40 exposed to 1000 ppm) it was interpreted as being unrelated to the exposure.

No evidence of fatty infiltration of the liver was observed in the experimental rats, although 2 of 40 controls showed this change.

No lesions were observed in dogs and monkeys which could possibly be related to the exposure. In fact, very few lesions, other than an occasional intestinal nematode, were observed in any of the dogs. The only significant lesion observed in monkeys was the presence of pulmonary acariasis, which was noted in both the controls and experimentals.

The experimental findings indicate that the pathological alterations observed with 1,1,1-trichloroethane are similar to those observed with dichloromethane except for different time courses of the effects and different degrees of recovery. A ten-fold greater atmospheric concentration of 1,1,1-trichloroethane is required to produce the minimal liver changes found at 100 ppm of dichloromethane. Thus we have achieved an exposure level of TCE producing a similar effect to dichloroethane which in further experiments should allow direct comparisons between these two solvents.

APPENDIX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49.0
48.0
47.0
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45.0
44.0
43.0
42.0
41.0
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2
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8
10
12
14
16
08/05/73
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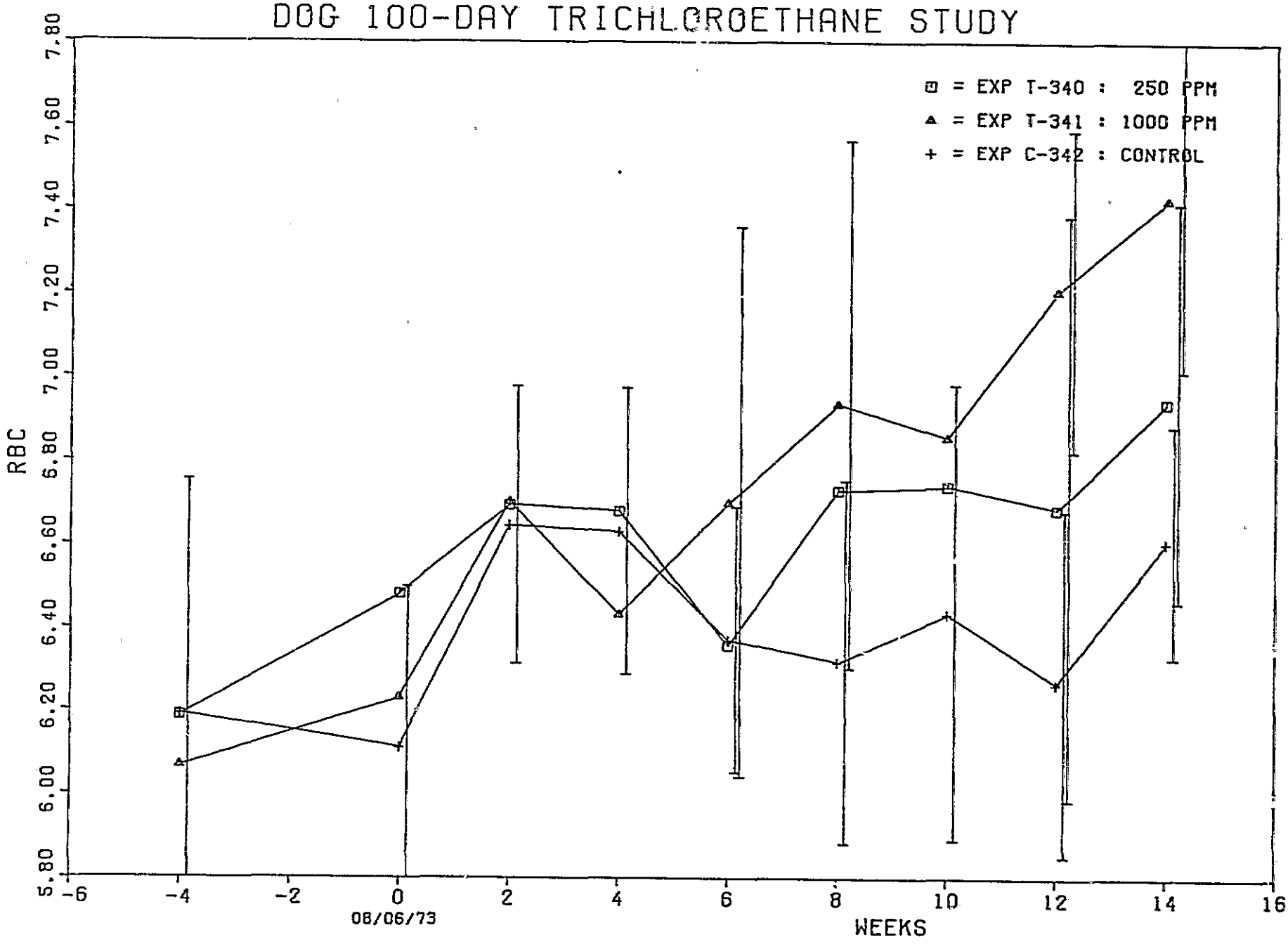
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7.40
7.20
7.00
6.80
6.60
6.40
6.20
6.00
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08/06/73
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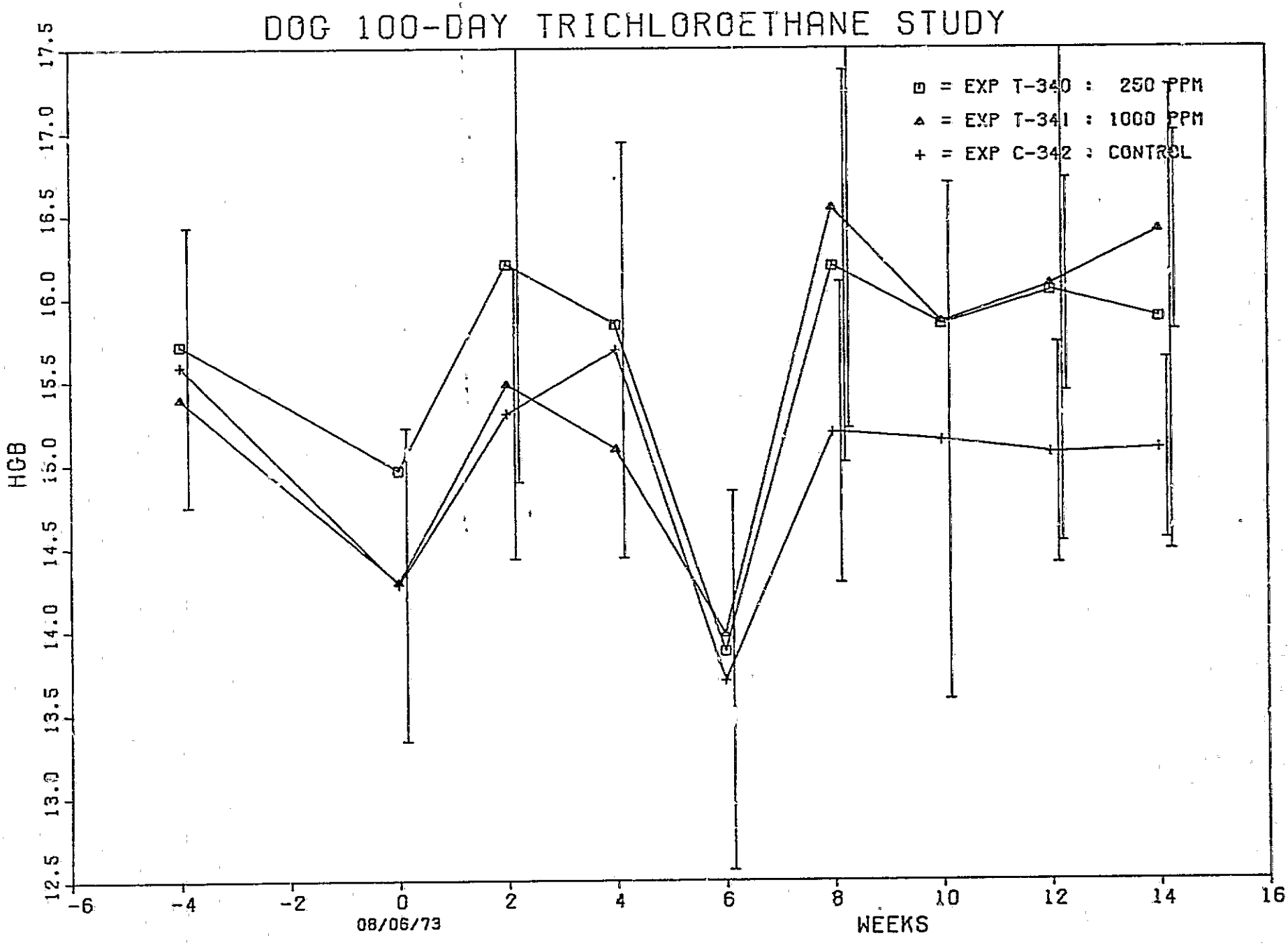
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16.0
16.5
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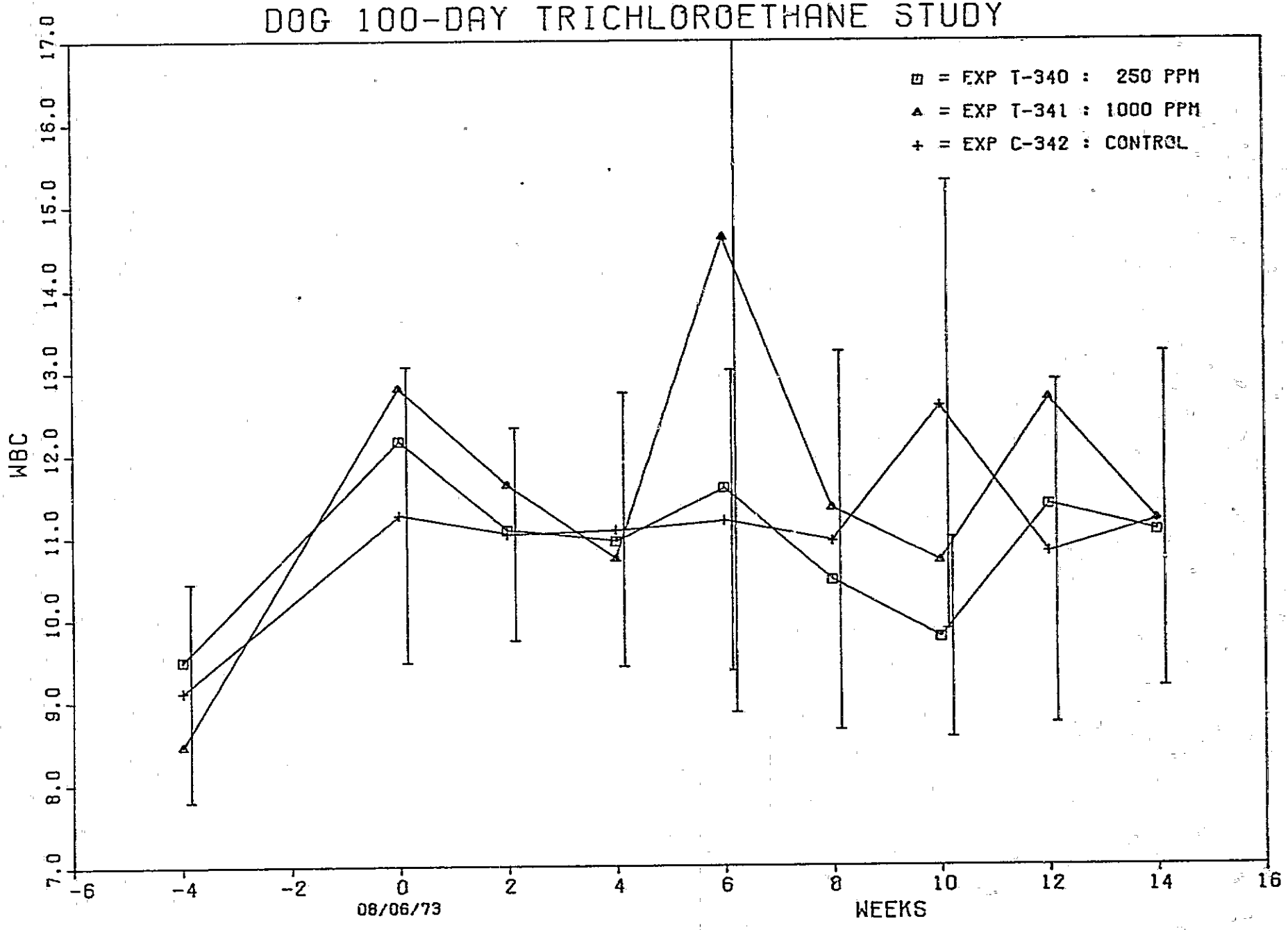
08/06/73
WEEKS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15.0
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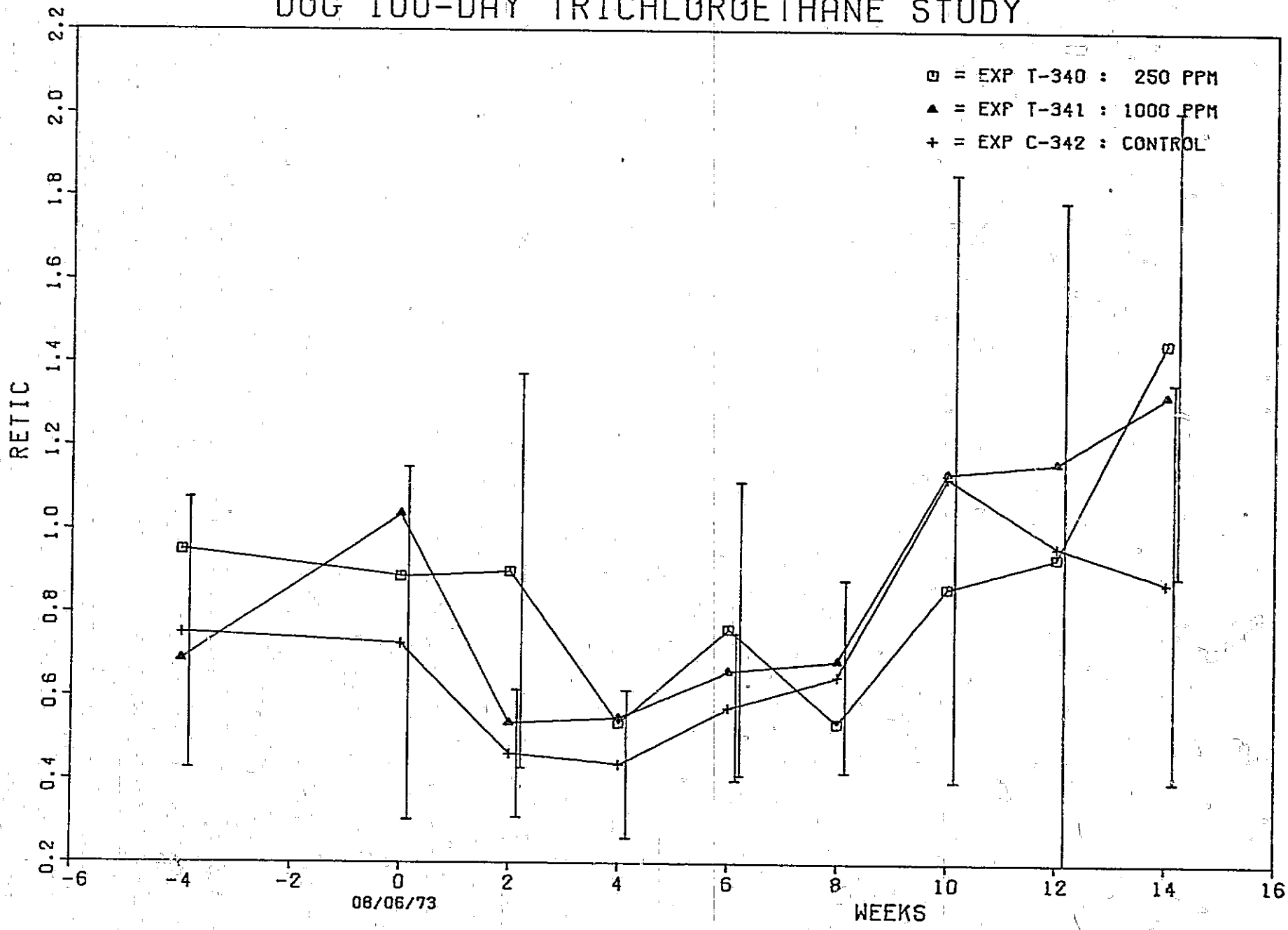
08/06/73
WEEKS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0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
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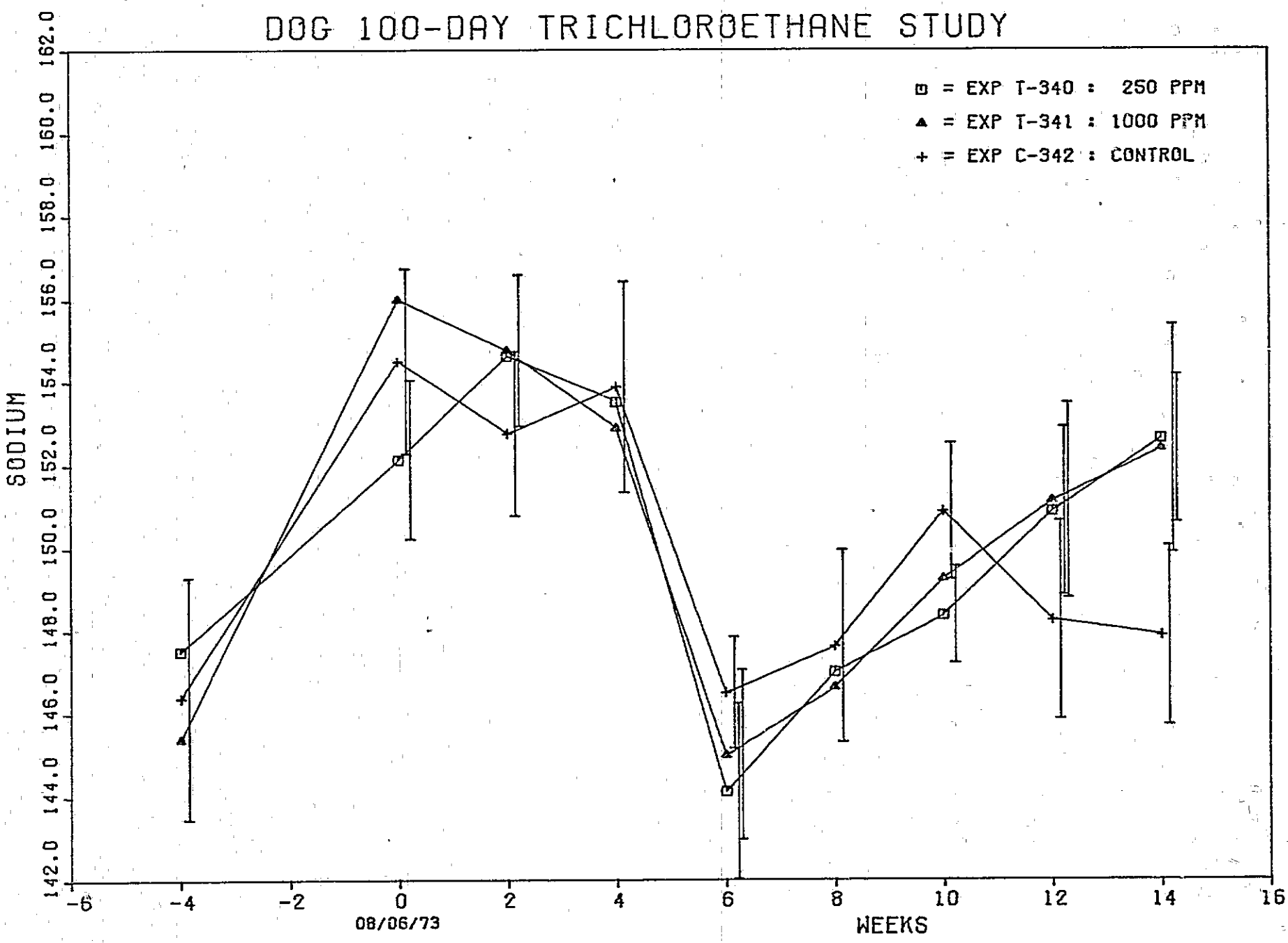
16
06/06/73
WEEKS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+ = EXP C-342 : CONTROL
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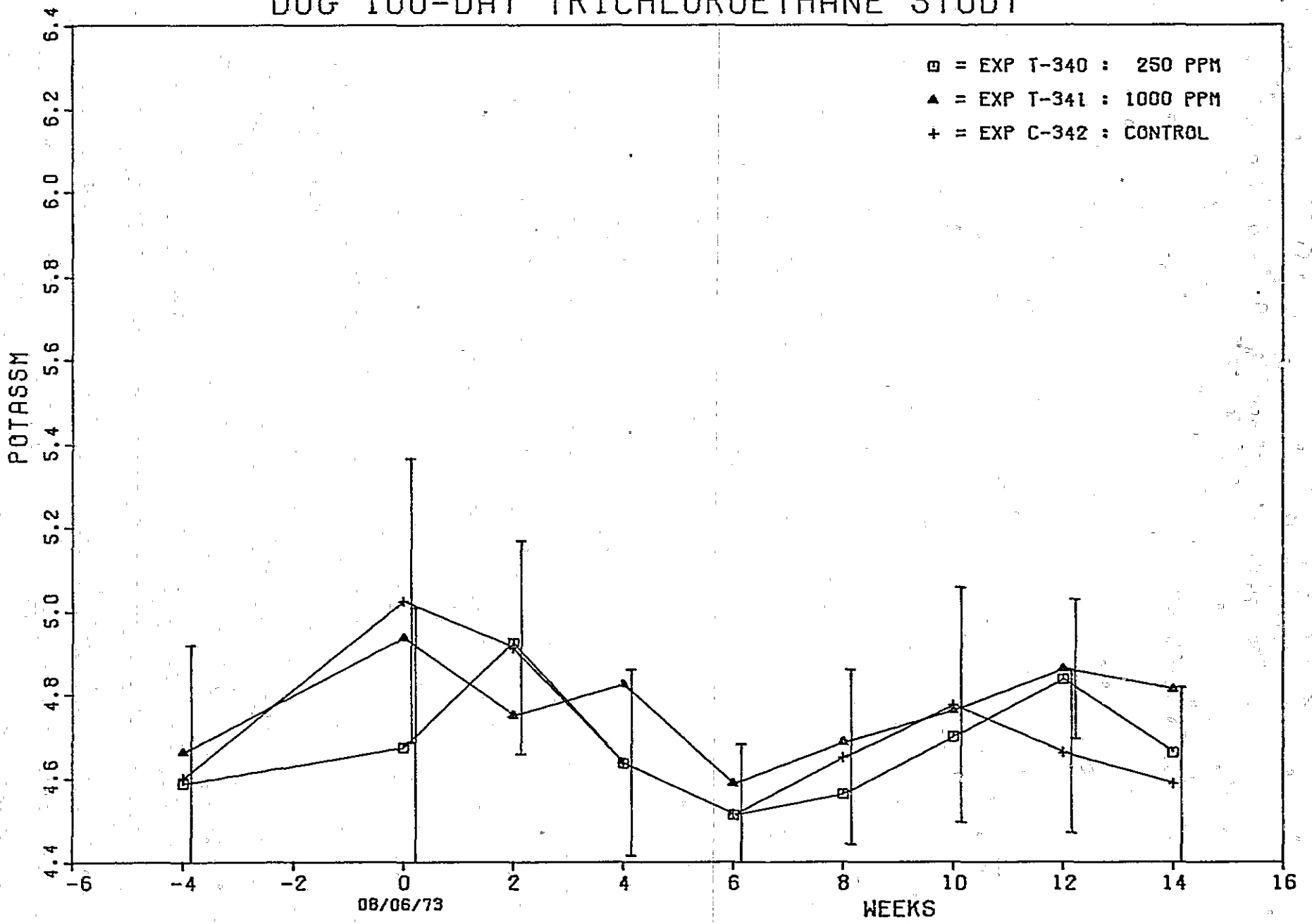
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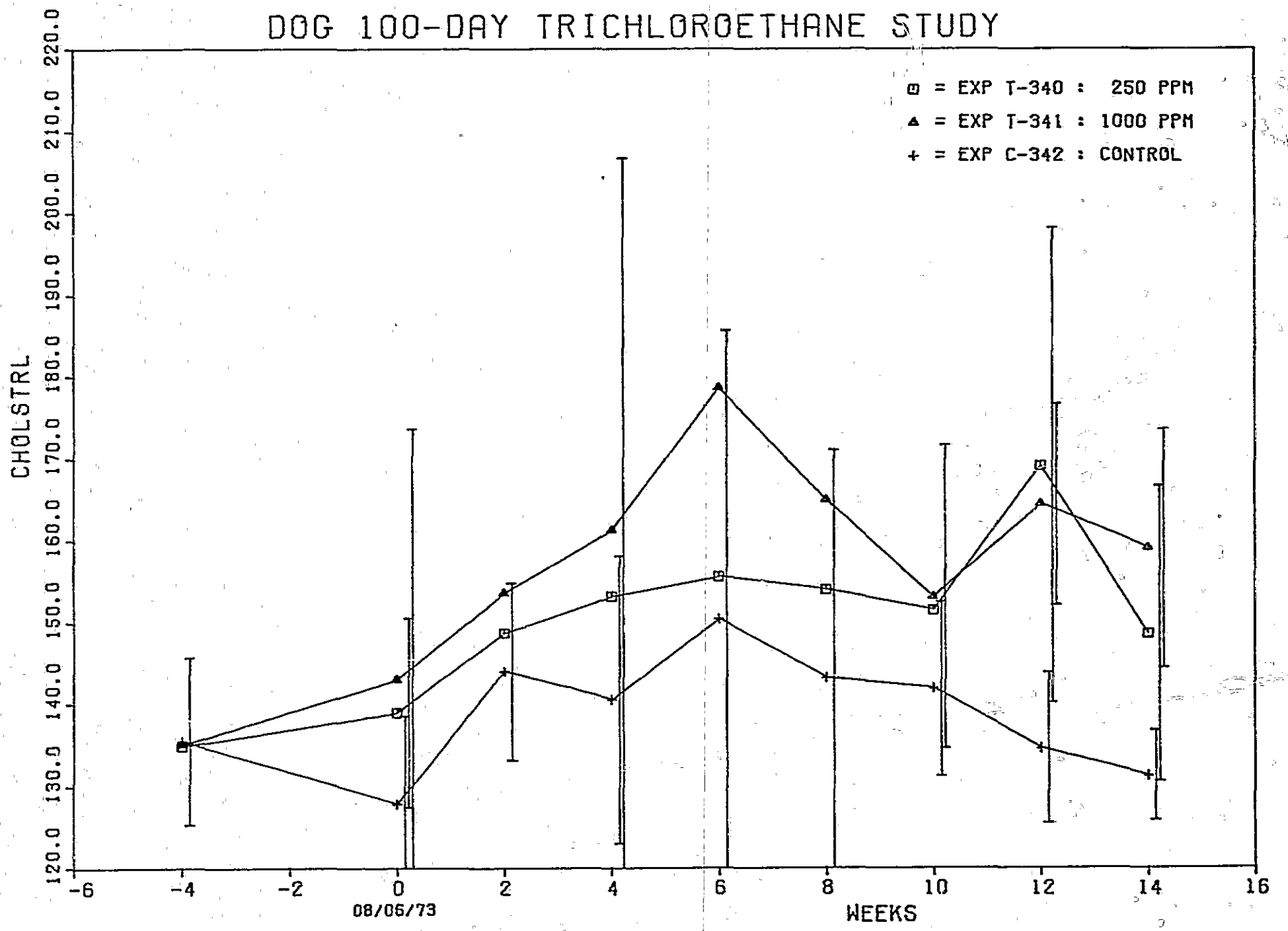
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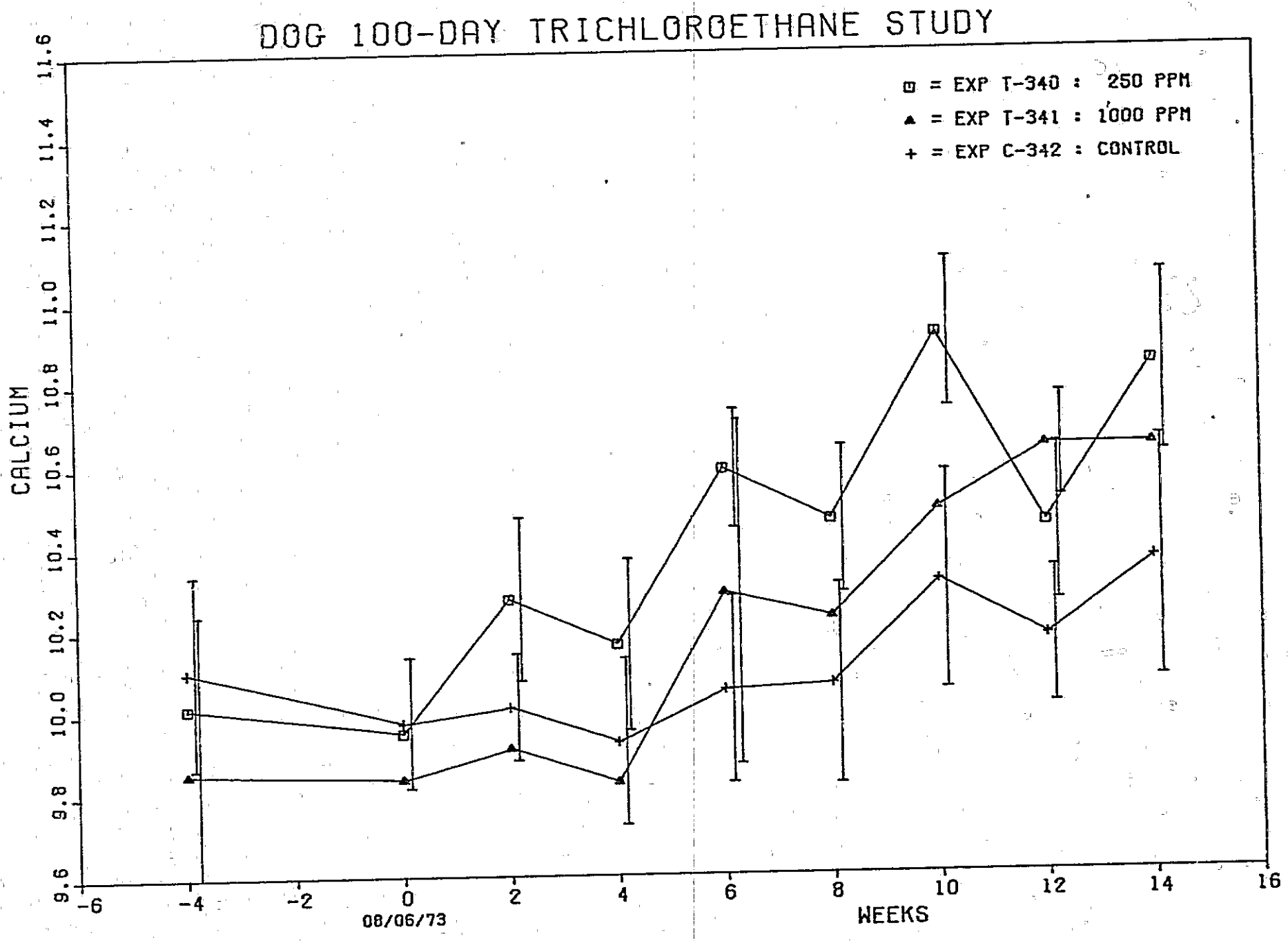
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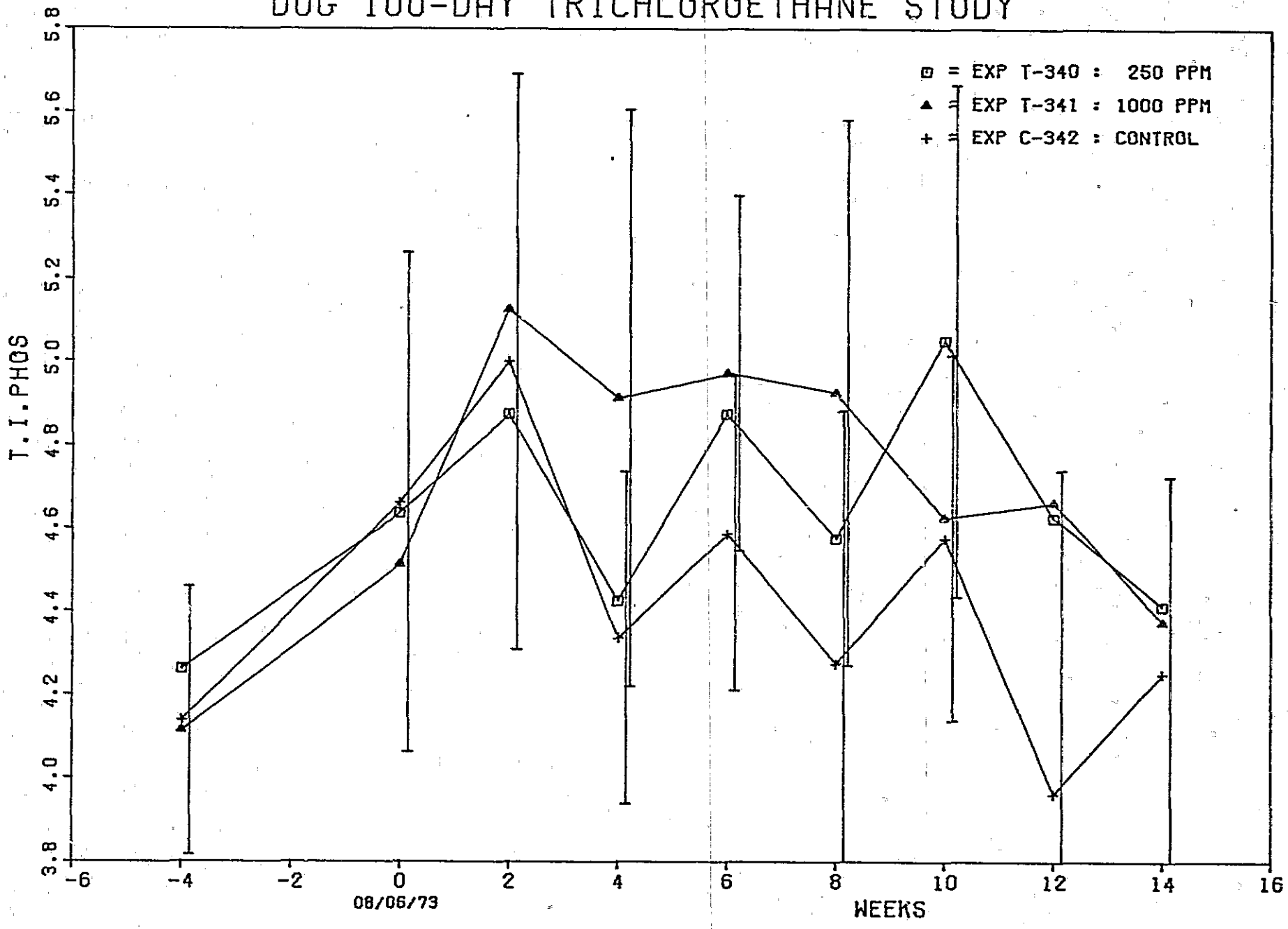
WEEKS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WEEKS

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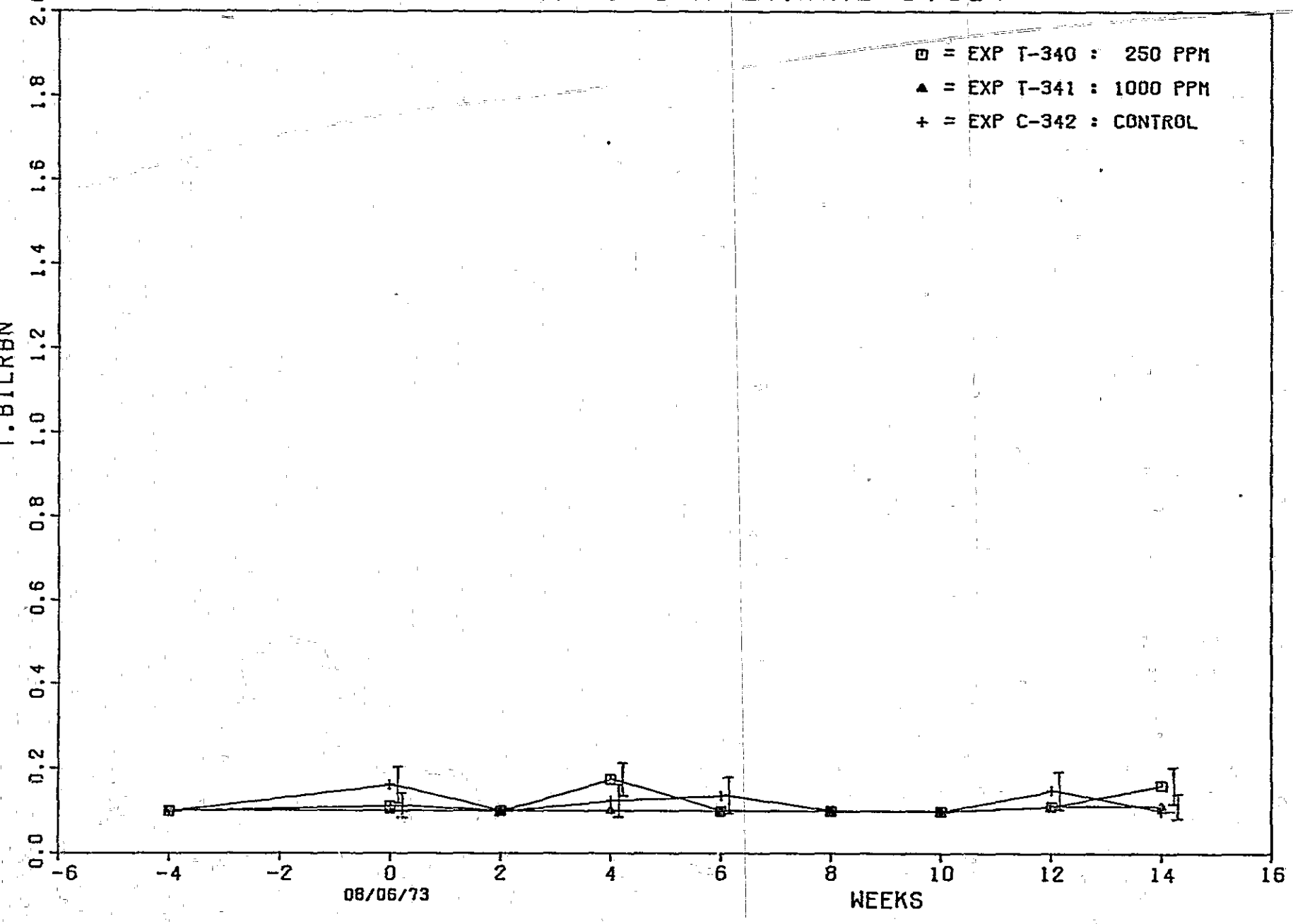

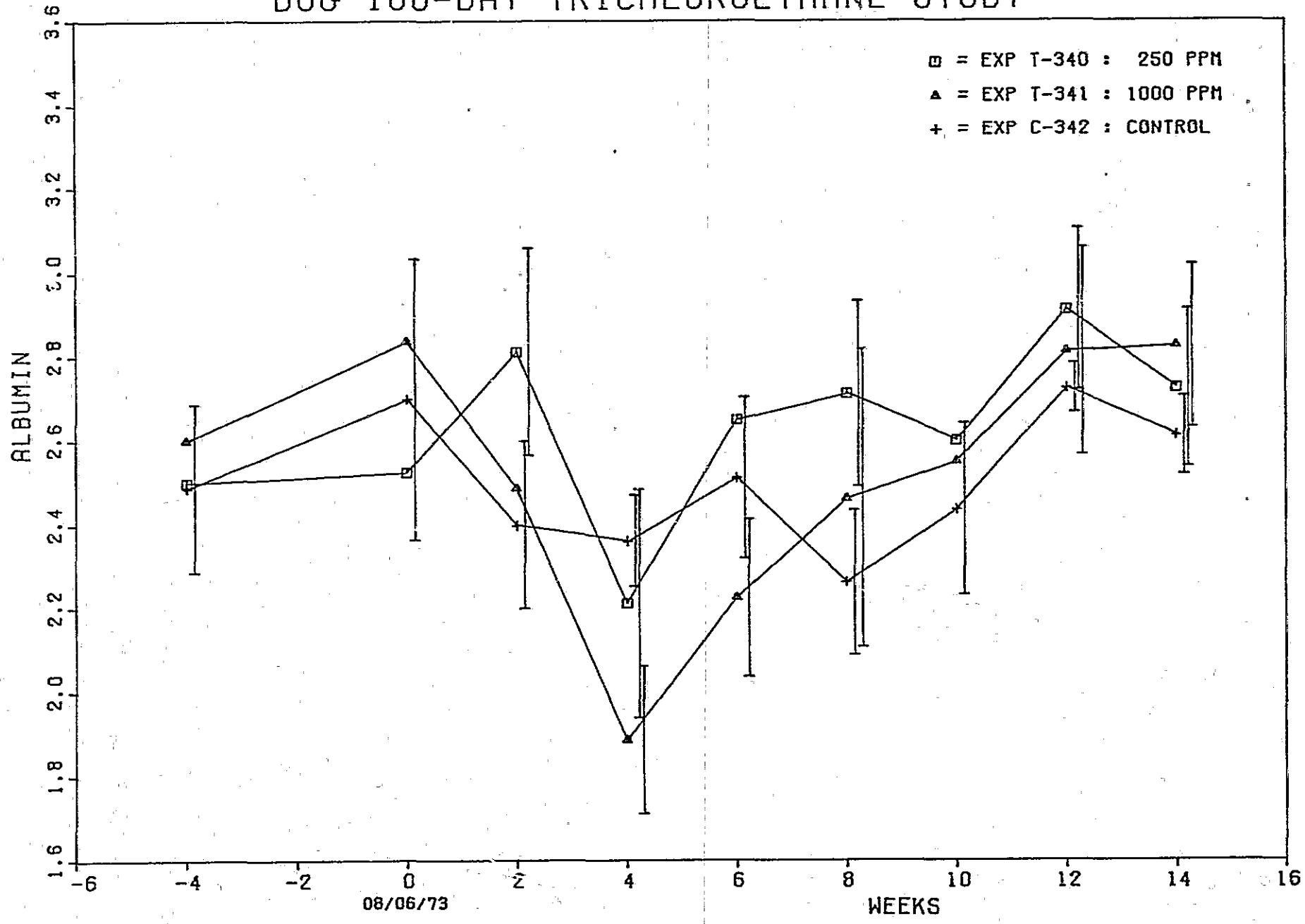
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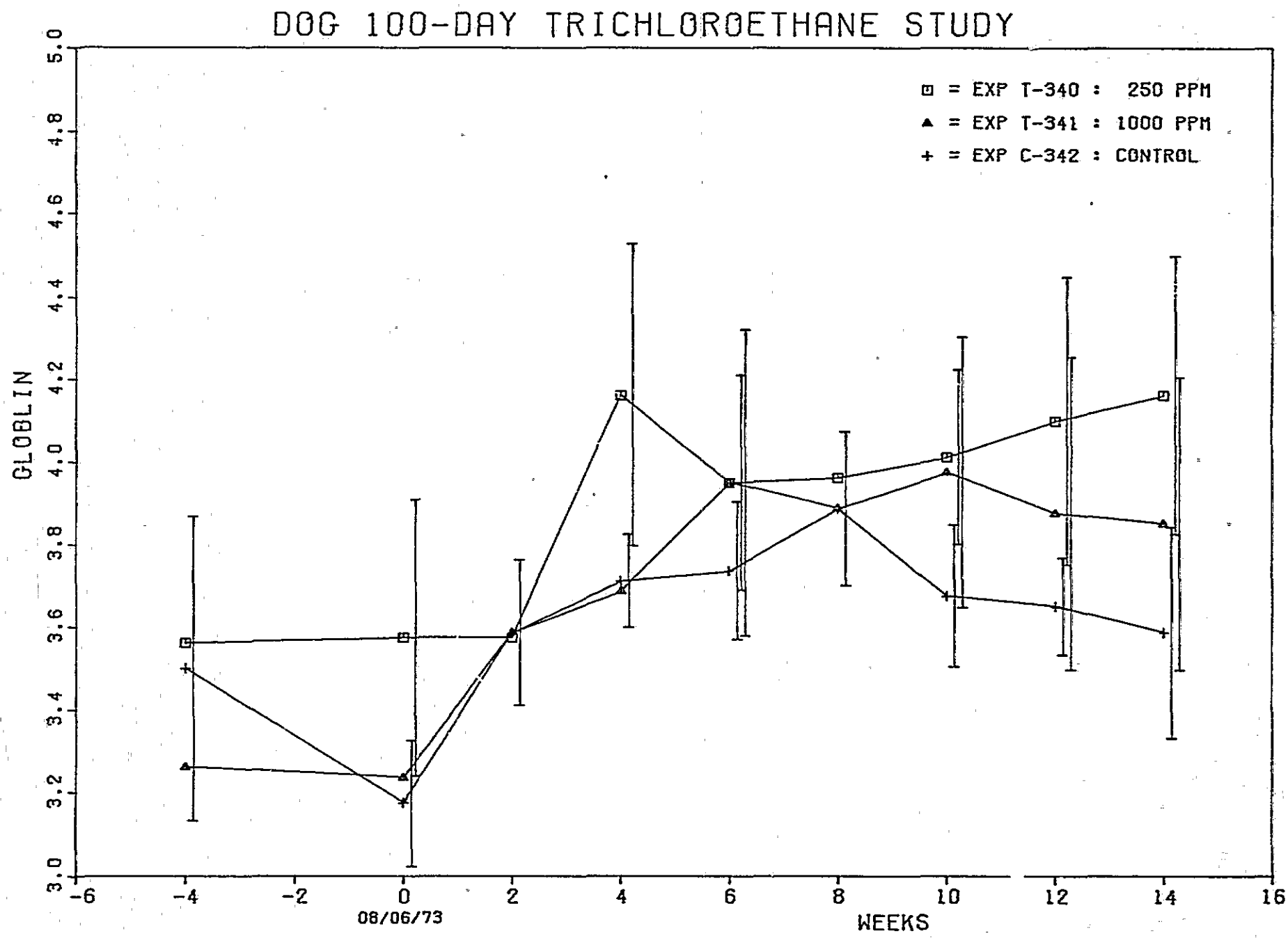
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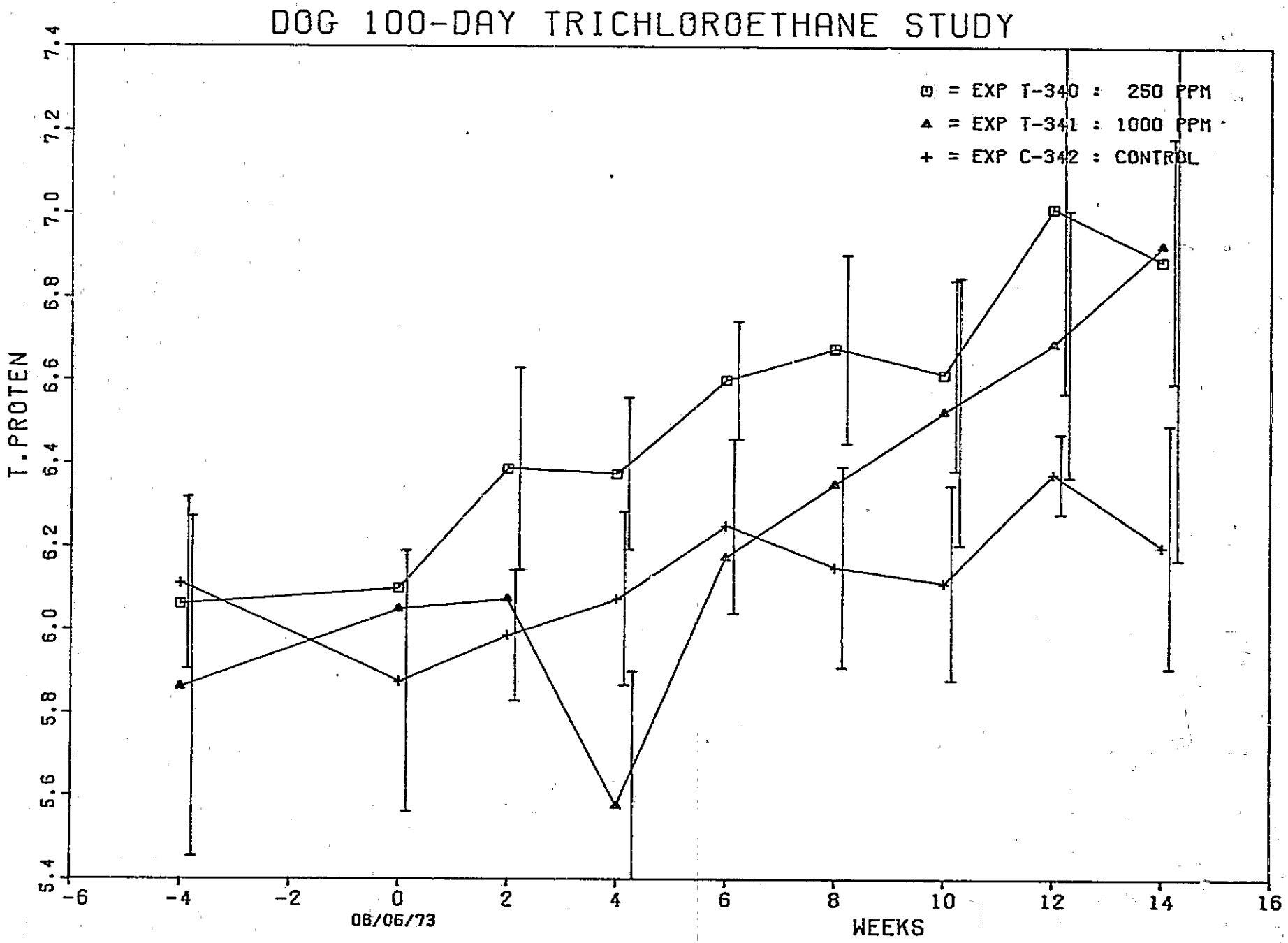
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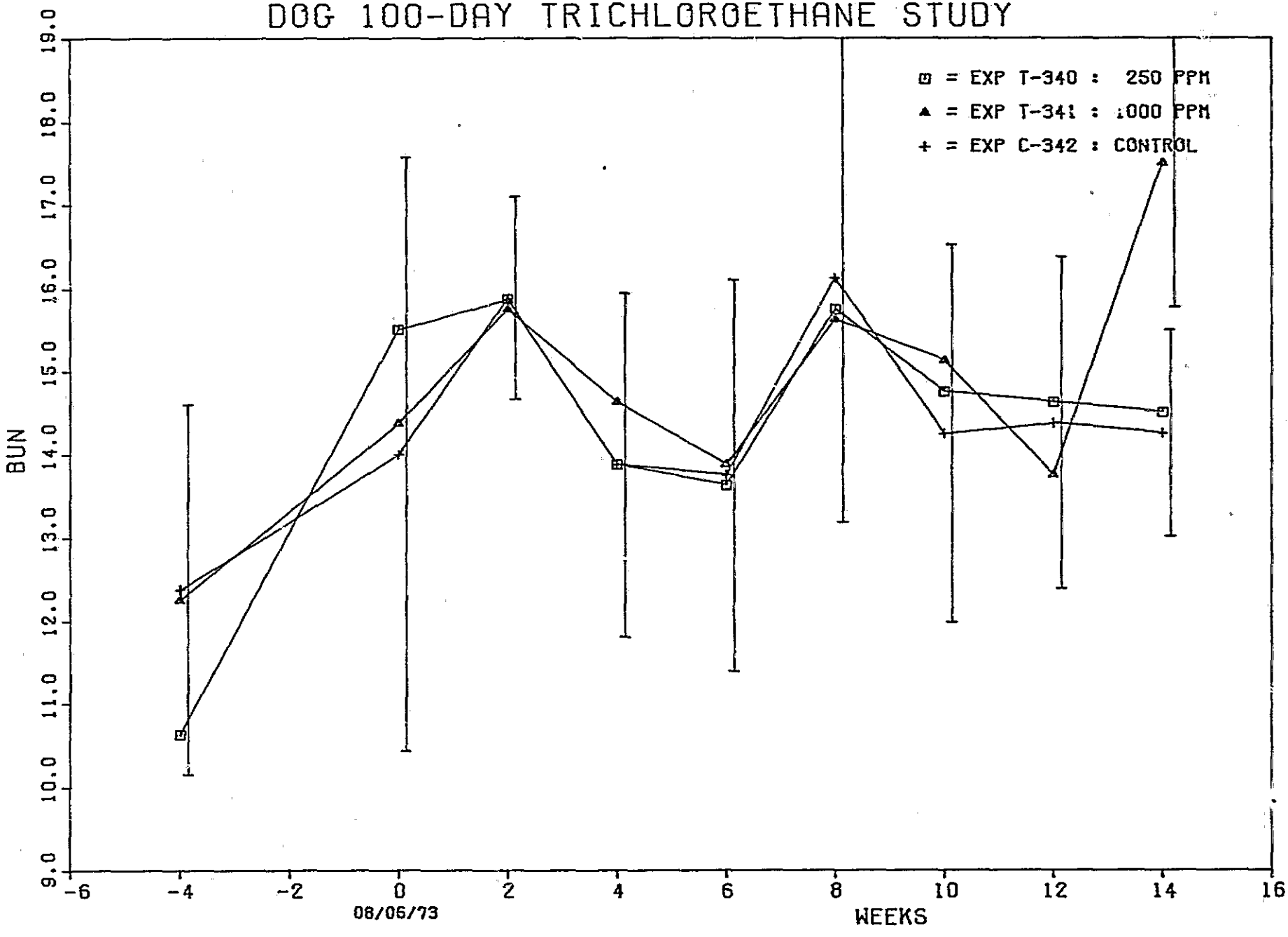
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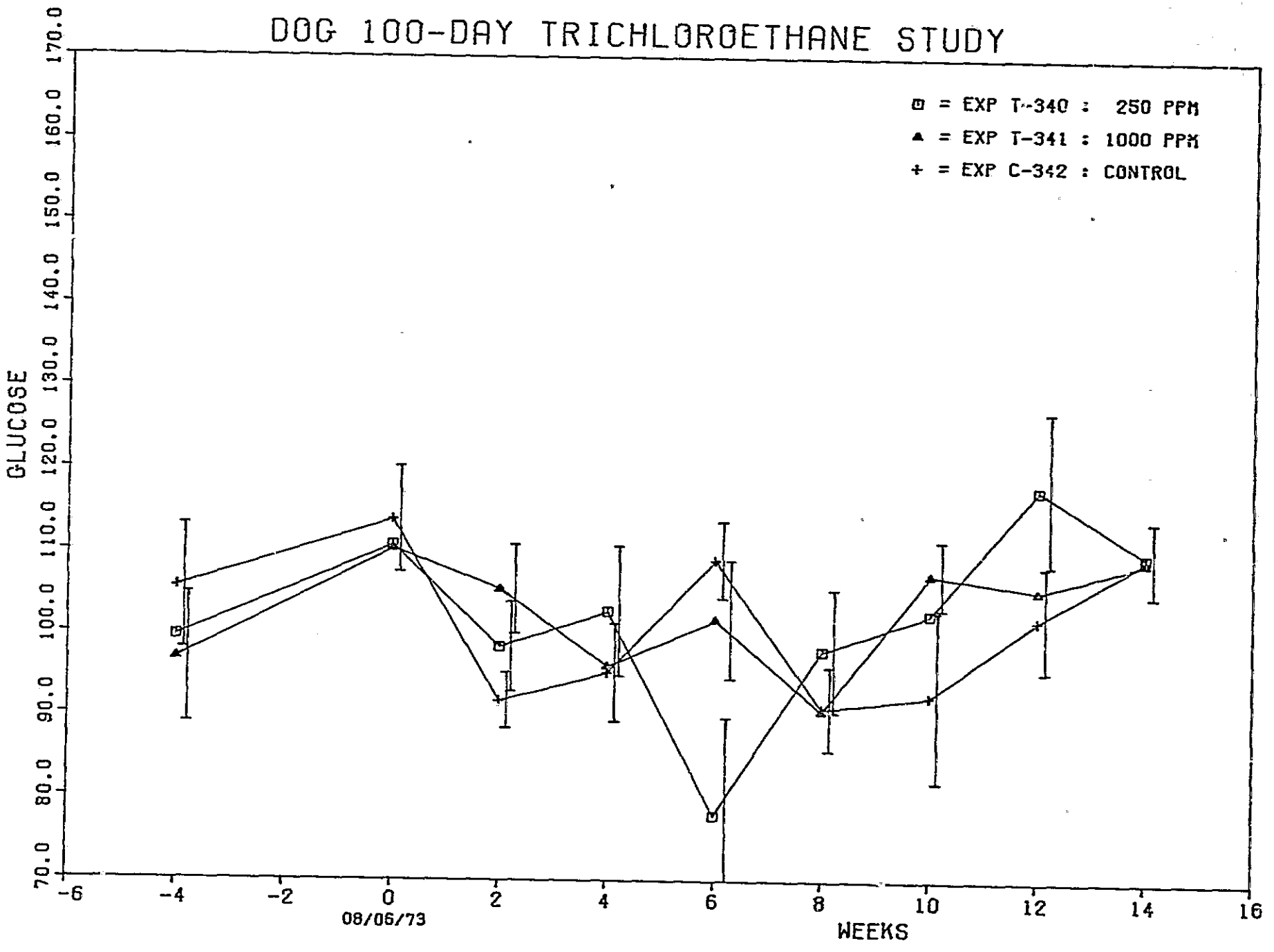
08/06/73
WEEKS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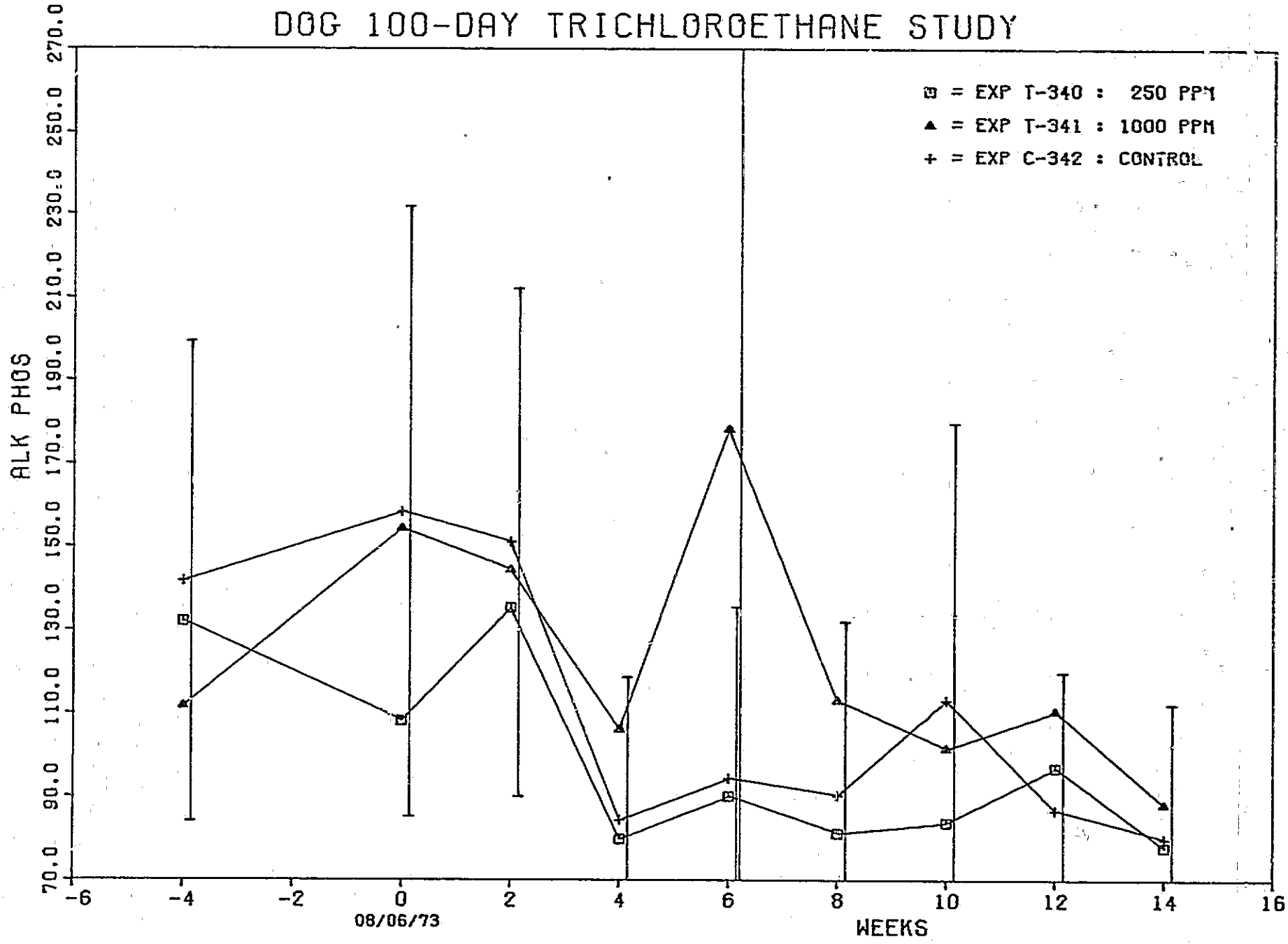
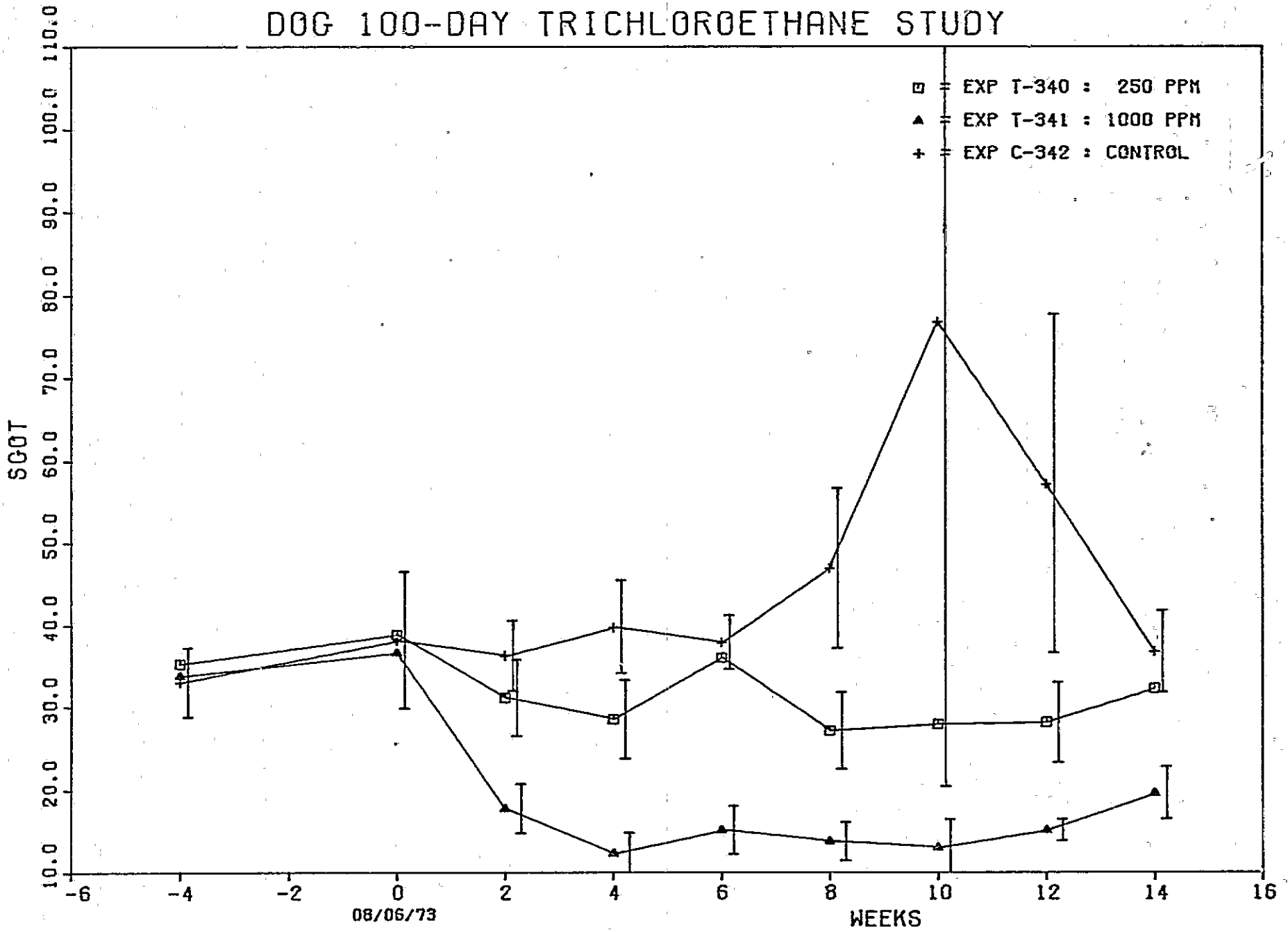
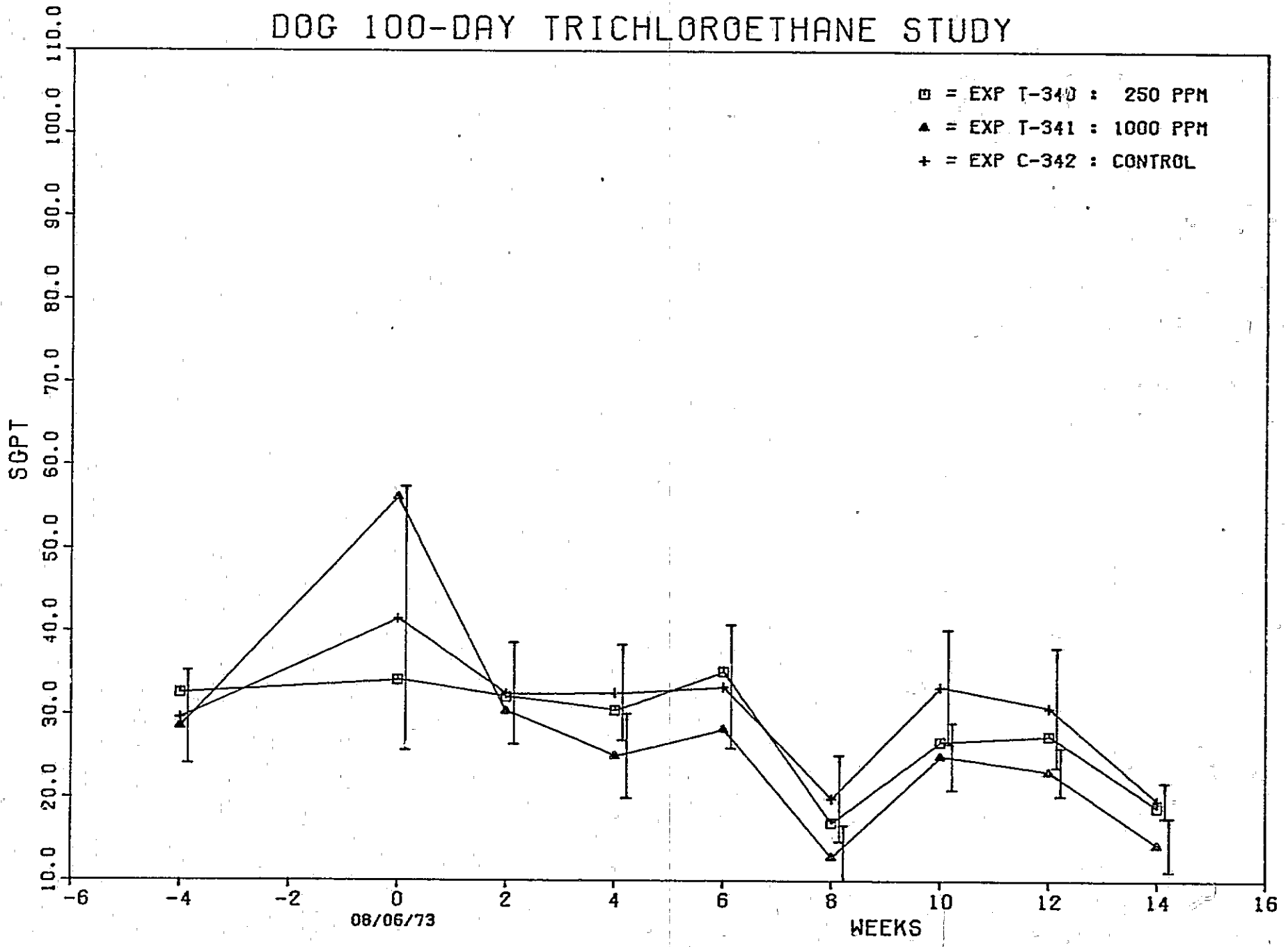
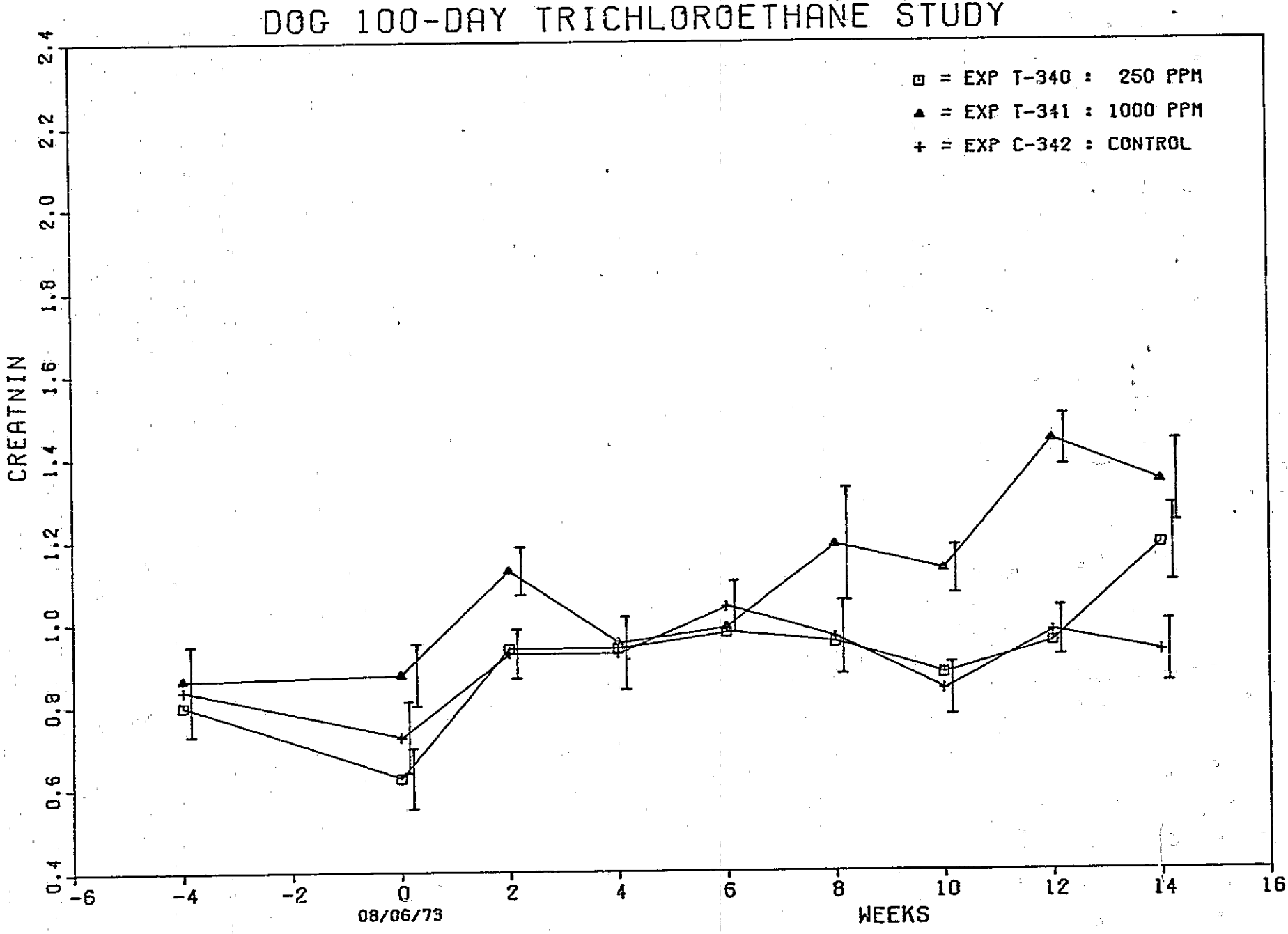
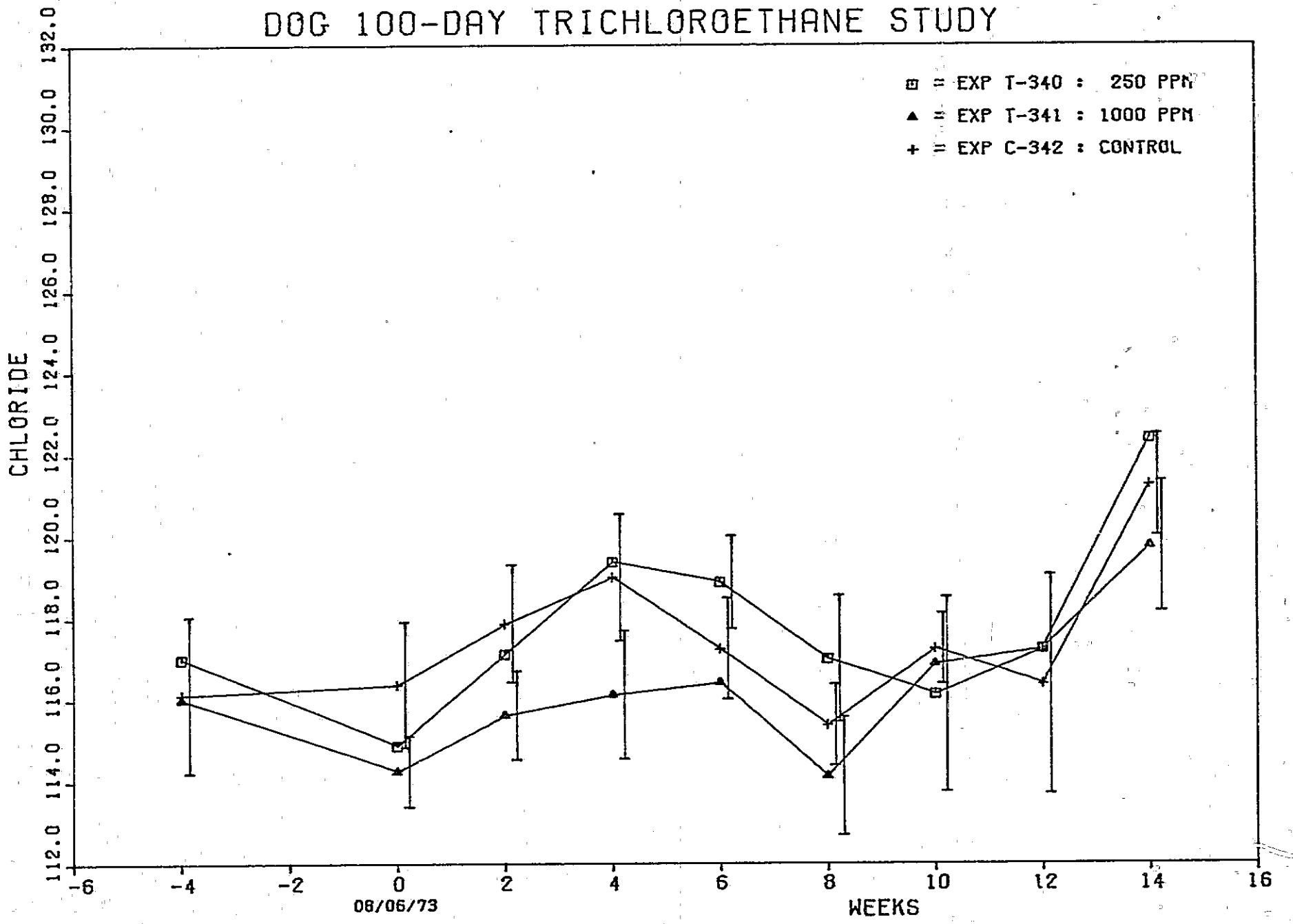
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
GLUCOSE
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

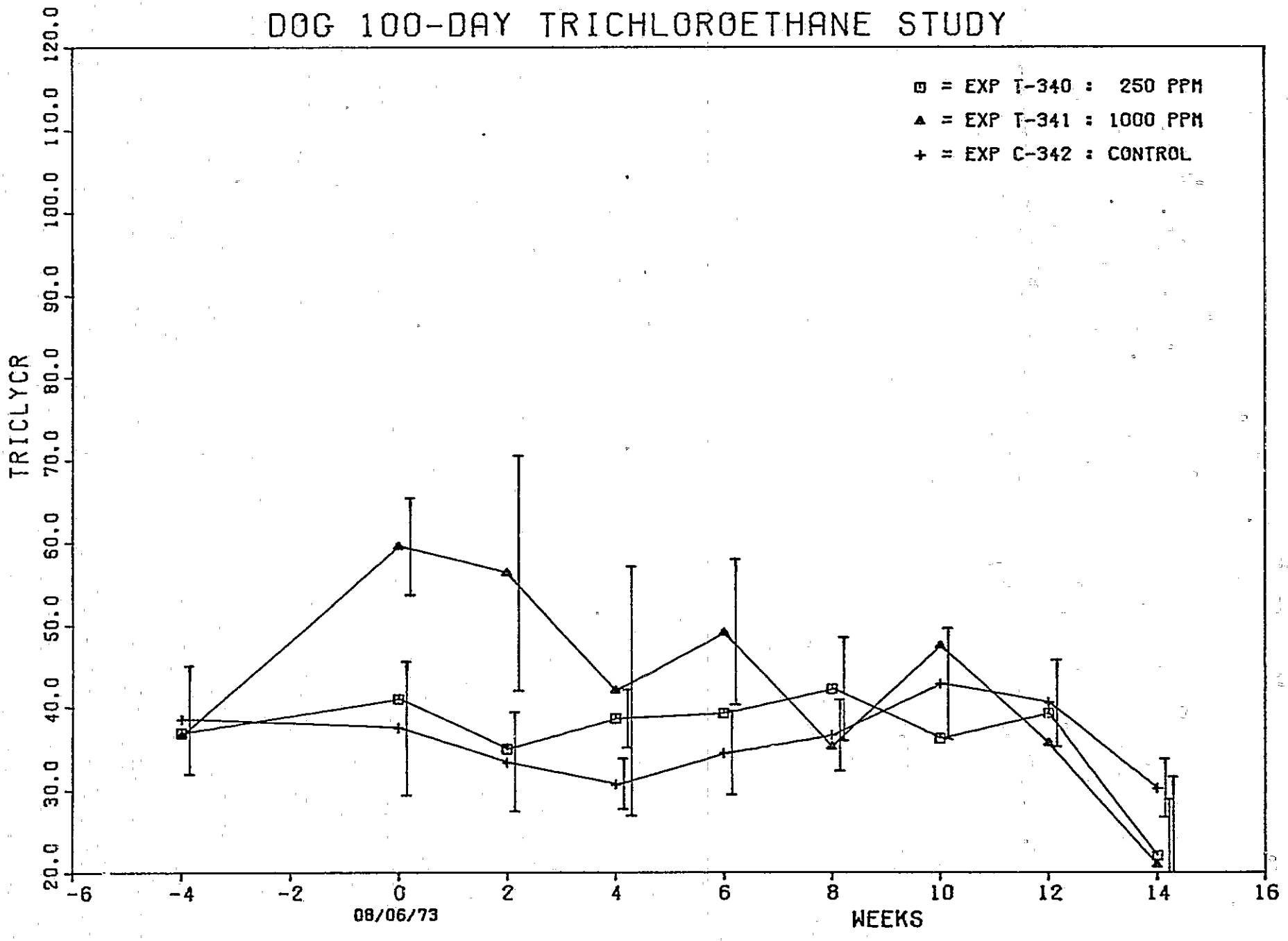

DOG 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
ALK PHOS
70.0
90.0
110.0
130.0
150.0
170.0
190.0
210.0
230.0
250.0
270.0
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

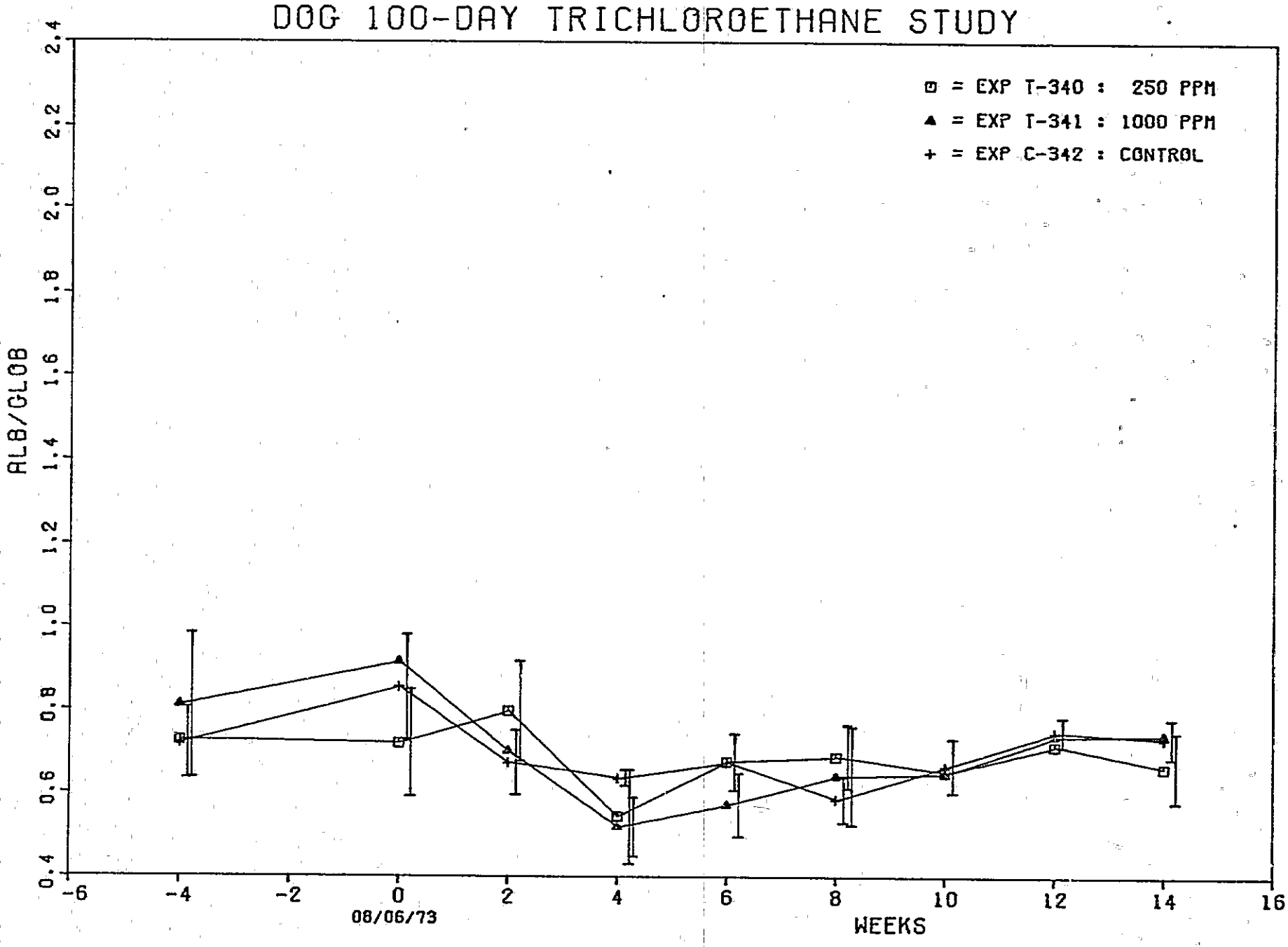

DOG 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
SGOT
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

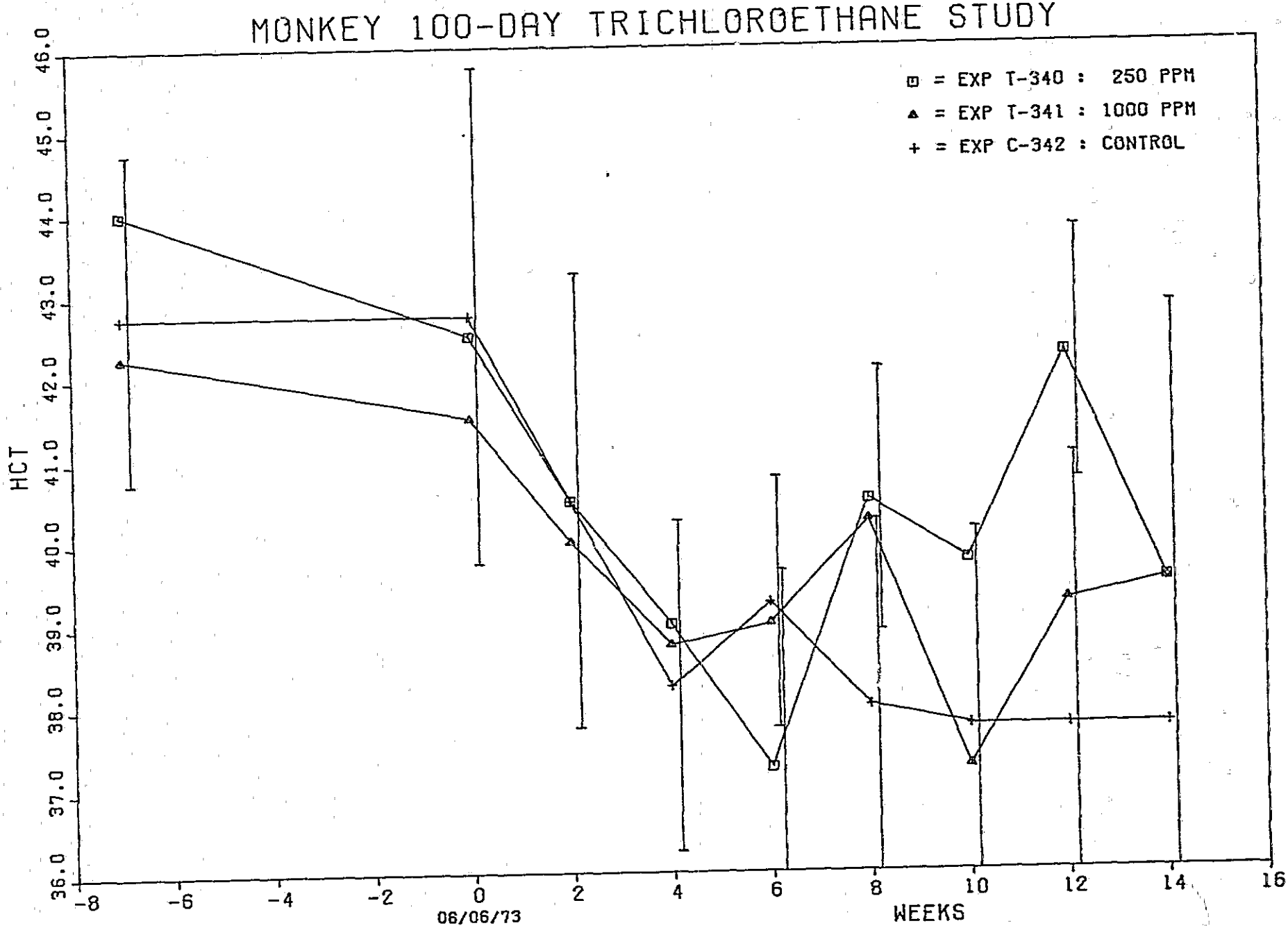

DOG 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
SGPT
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

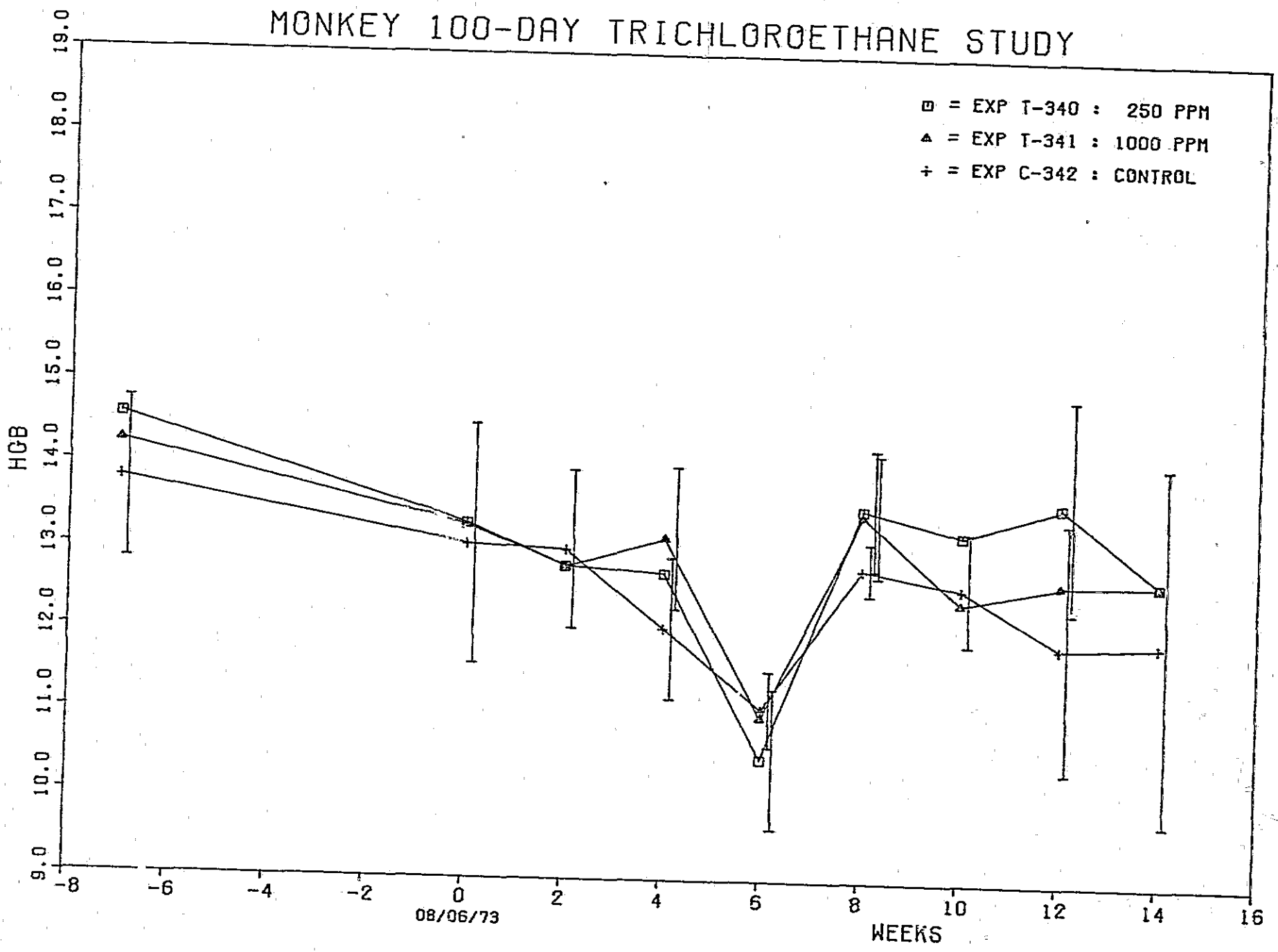

DOG 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
CREATNIN
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

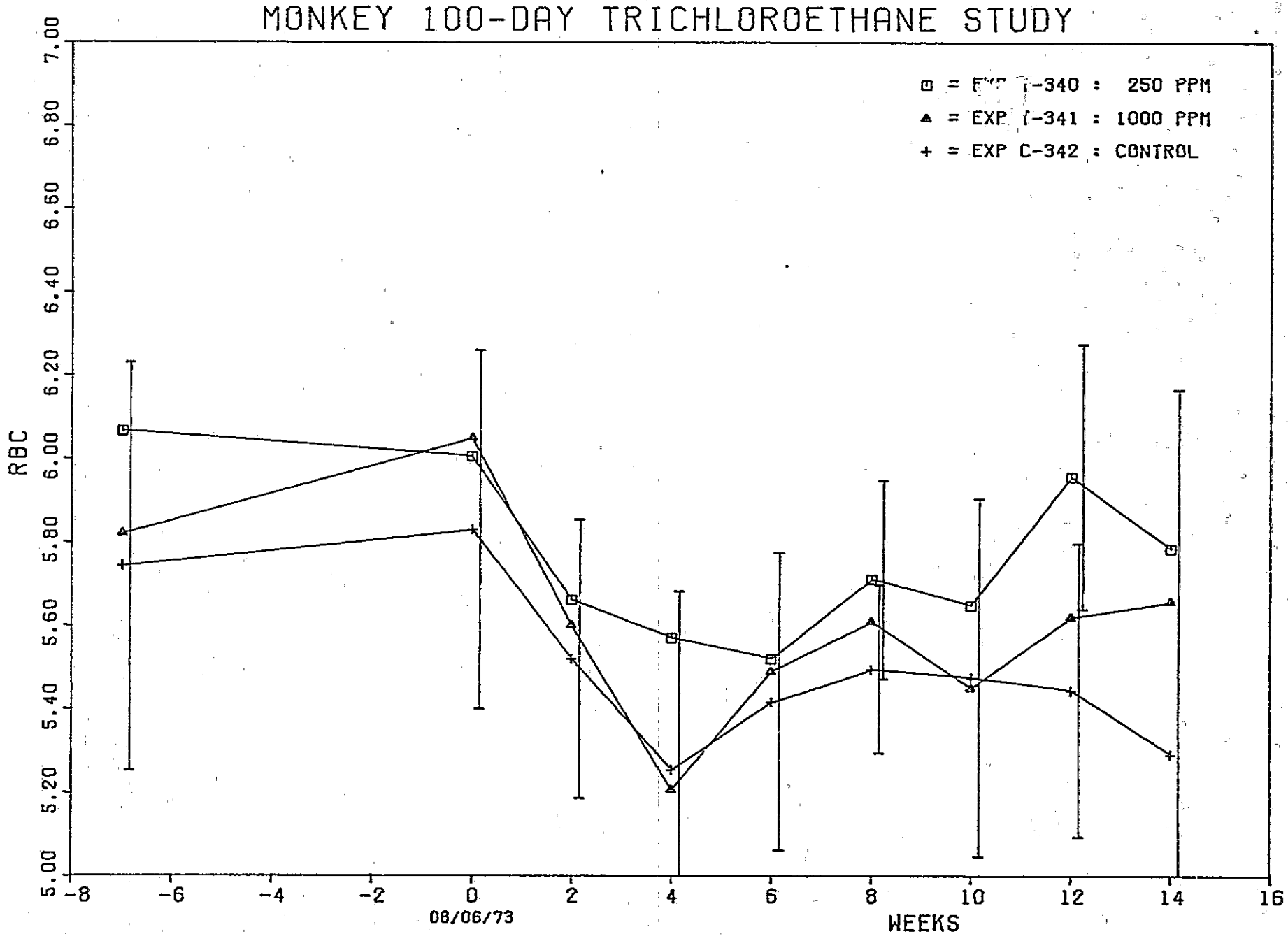

DOG 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
CHLORIDE
112.0
114.0
116.0
118.0
120.0
122.0
124.0
126.0
128.0
130.0
132.0
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

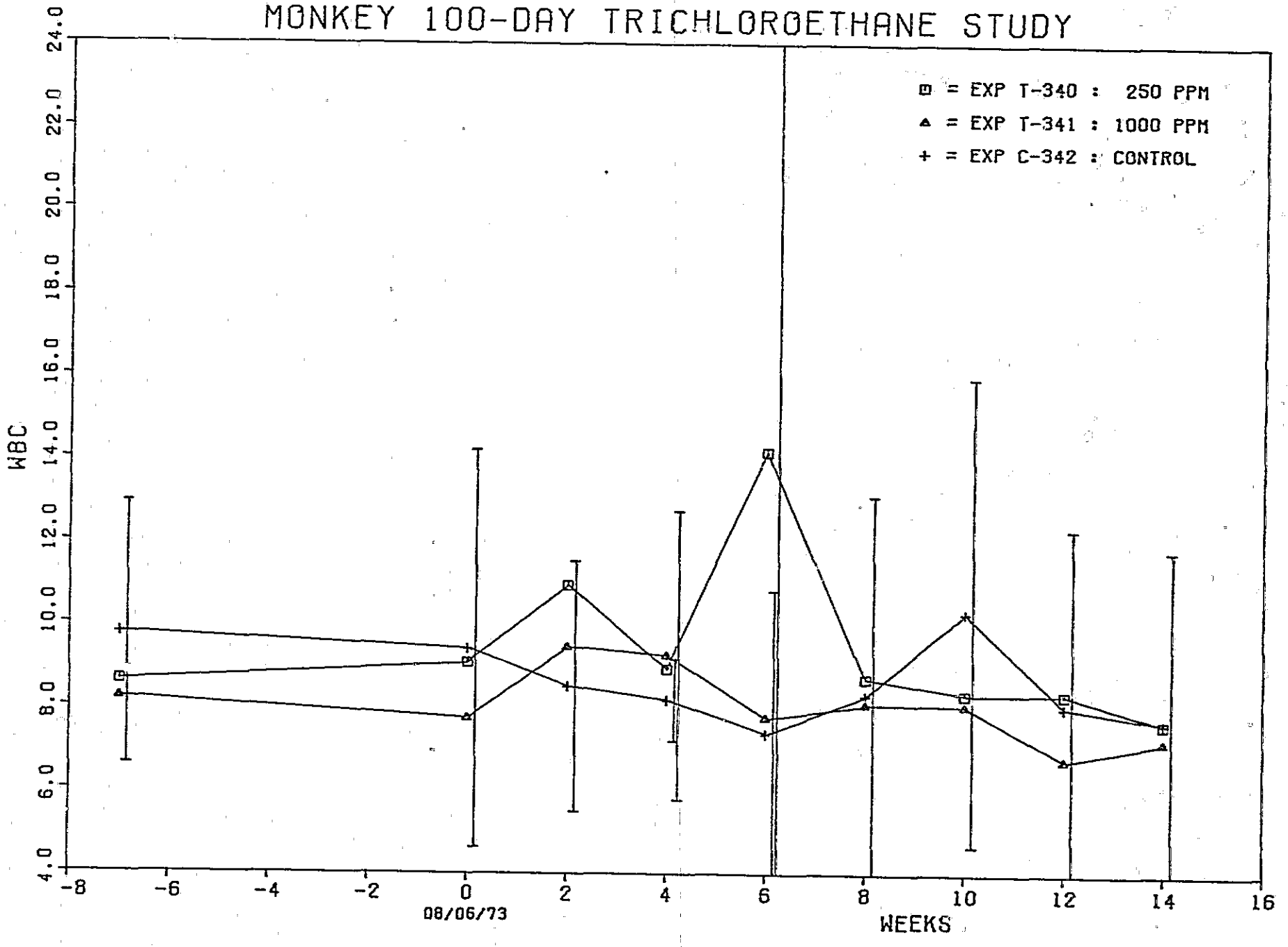

DOG 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
TRICLYCR
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

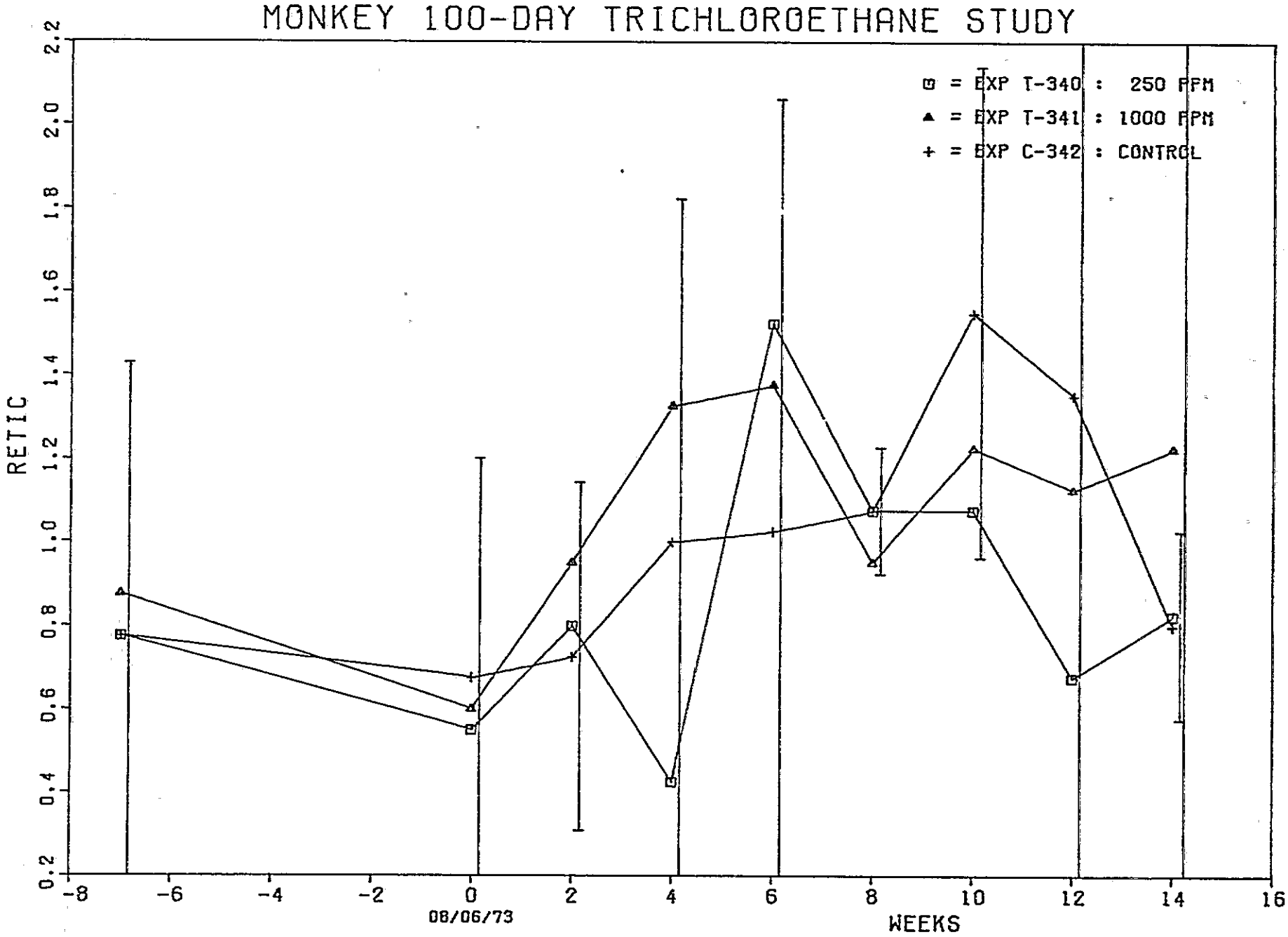

DOG 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
ALB/GLOB
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

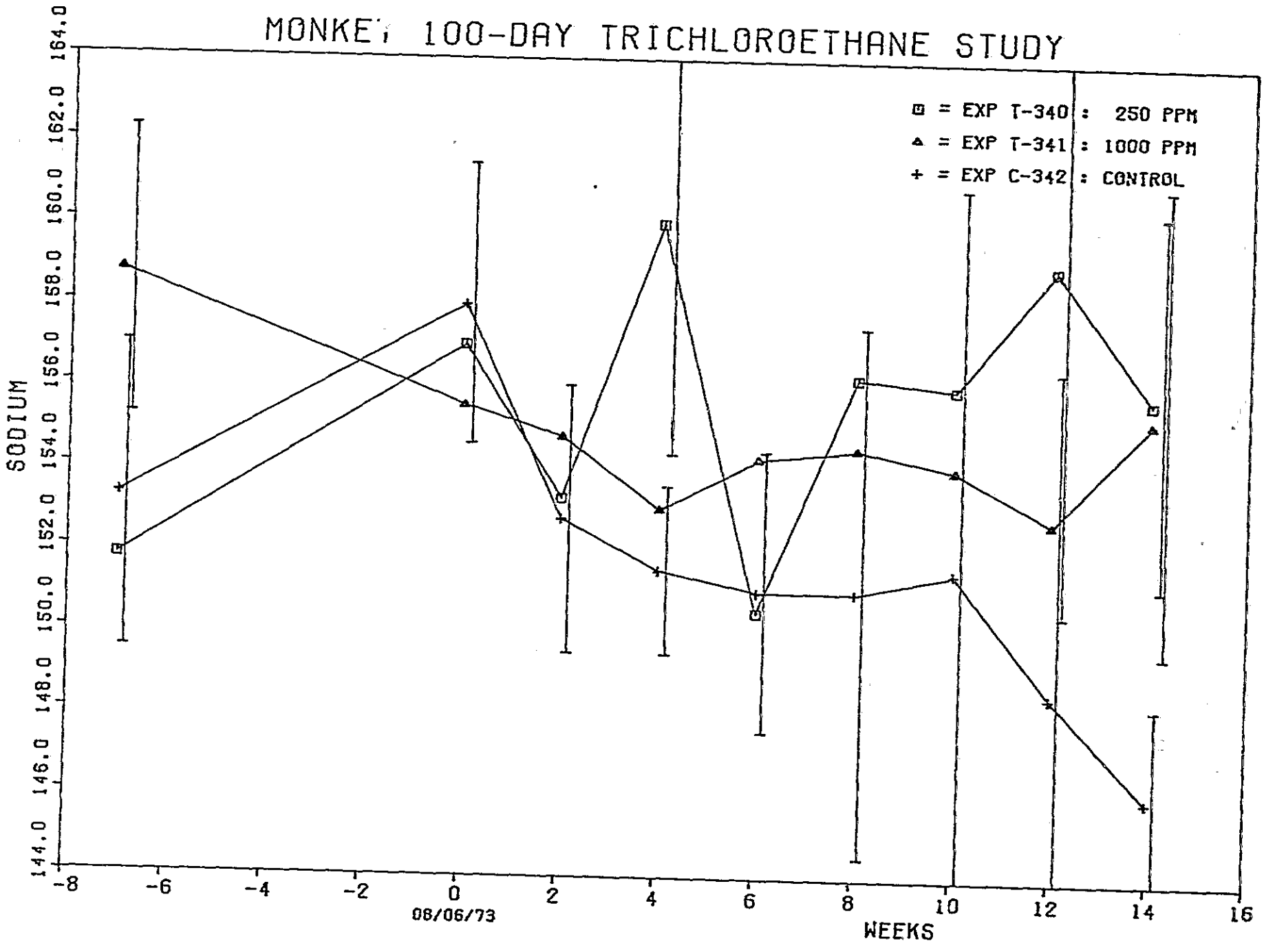

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
HCT
46.0
45.0
44.0
43.0
42.0
41.0
40.0
39.0
38.0
37.0
36.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
06/06/73
WEEKS

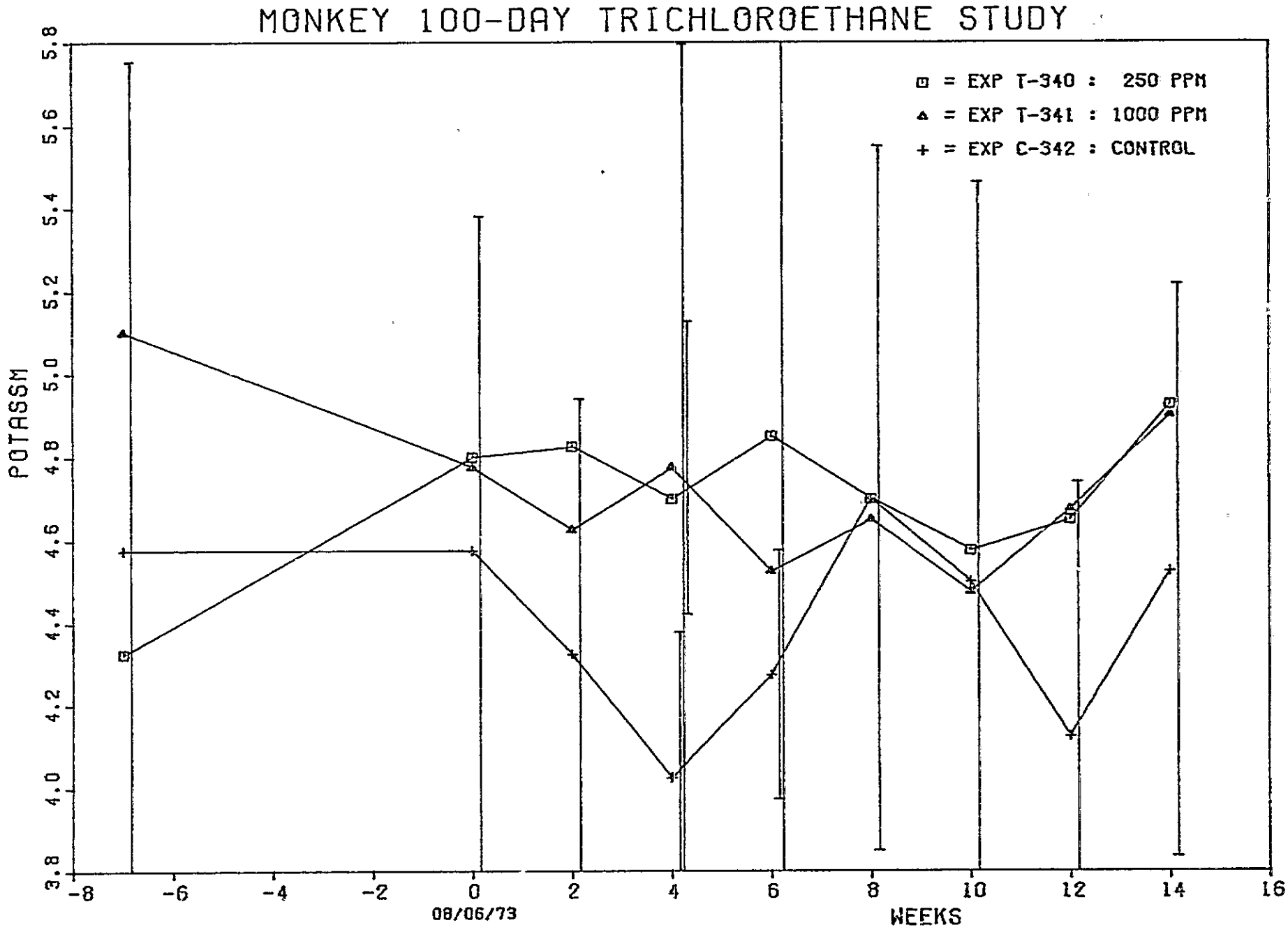

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
△ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
HGB
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

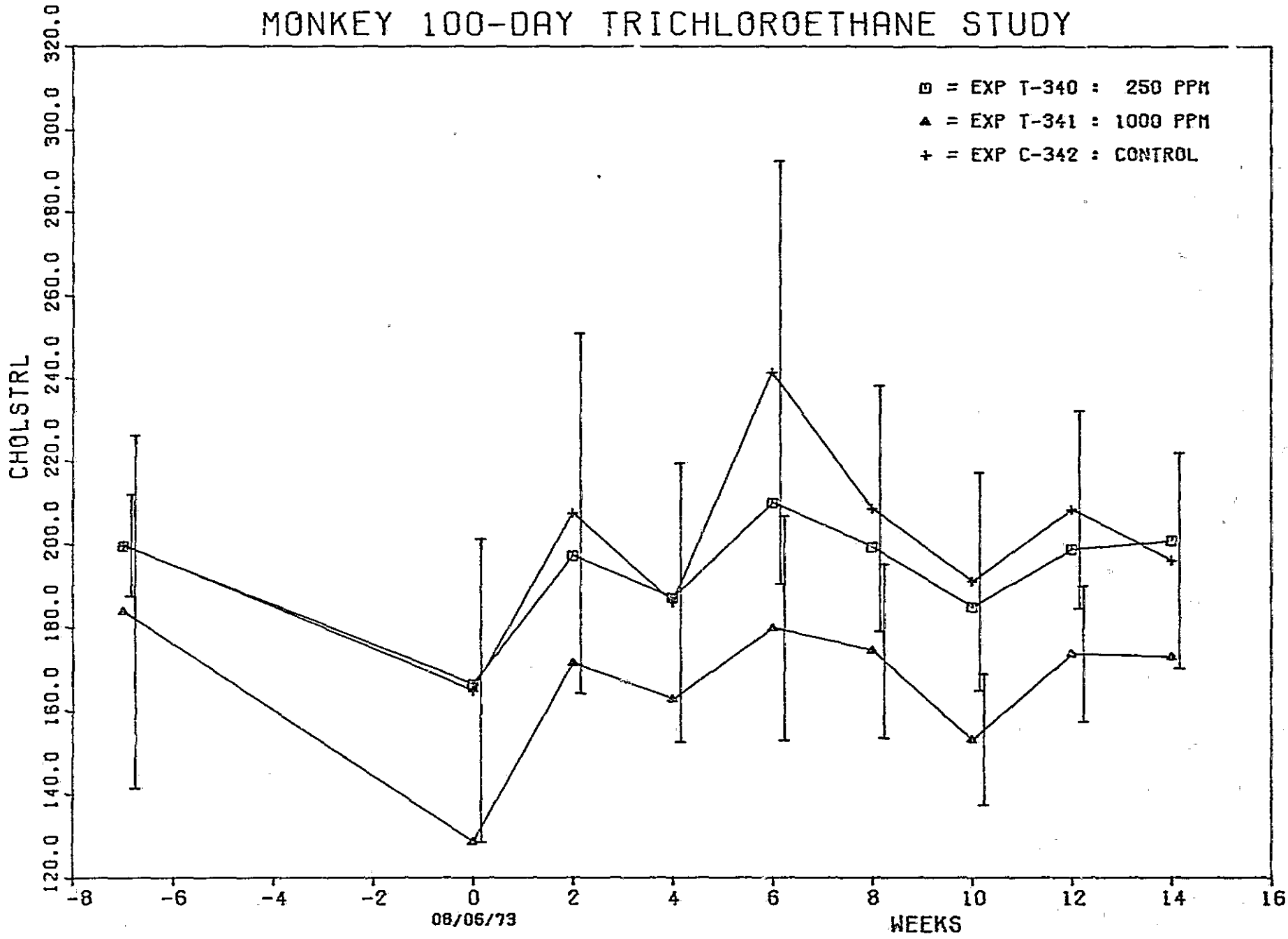

MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP C-340 : 250 PPM
△ = EXP C-341 : 1000 PPM
+ = EXP C-342 : CONTROL
RBC
5.00
5.20
5.40
5.60
5.80
6.00
6.20
6.40
6.60
6.80
7.00
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

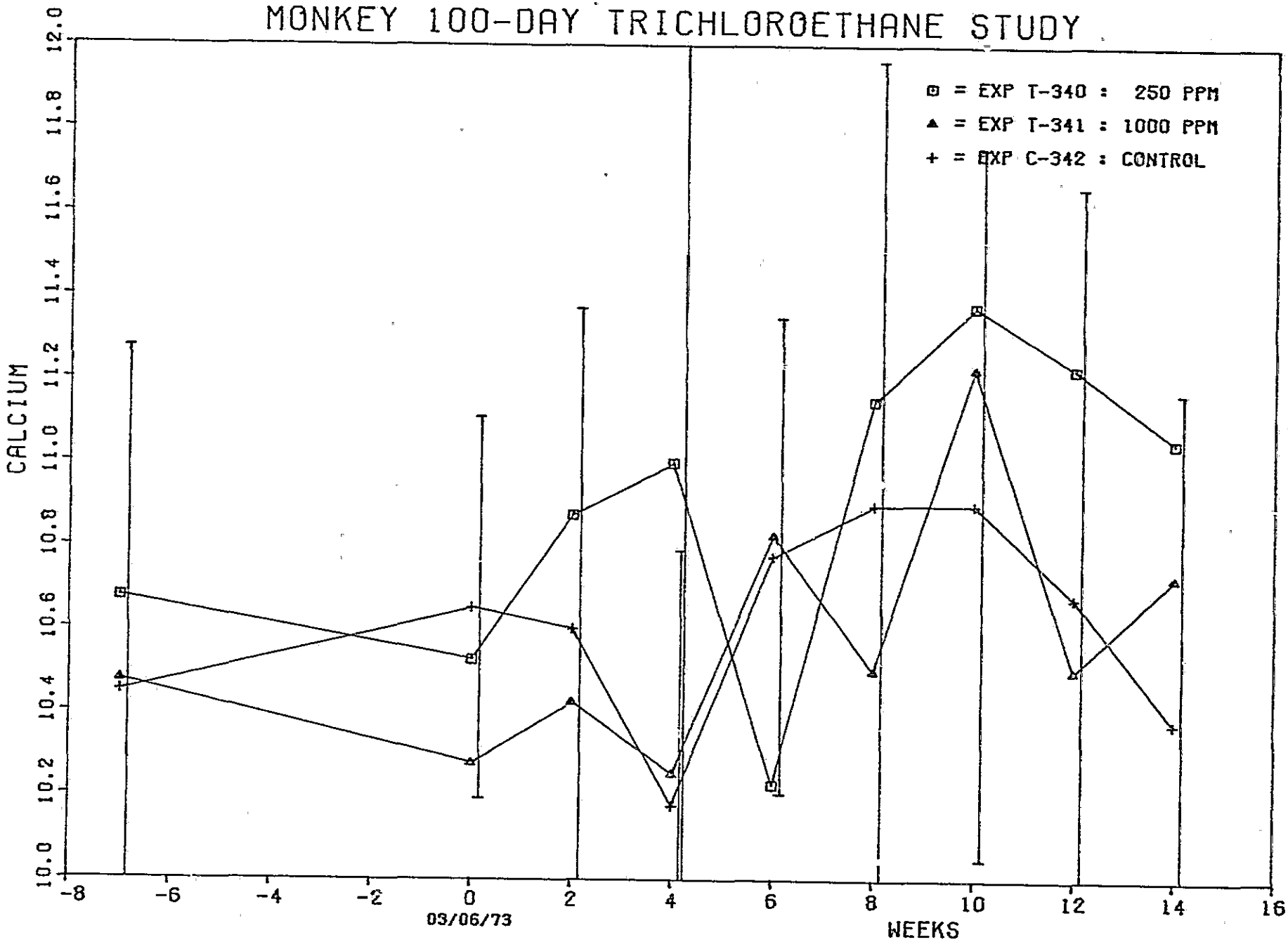

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
△ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
WBC
24.0
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

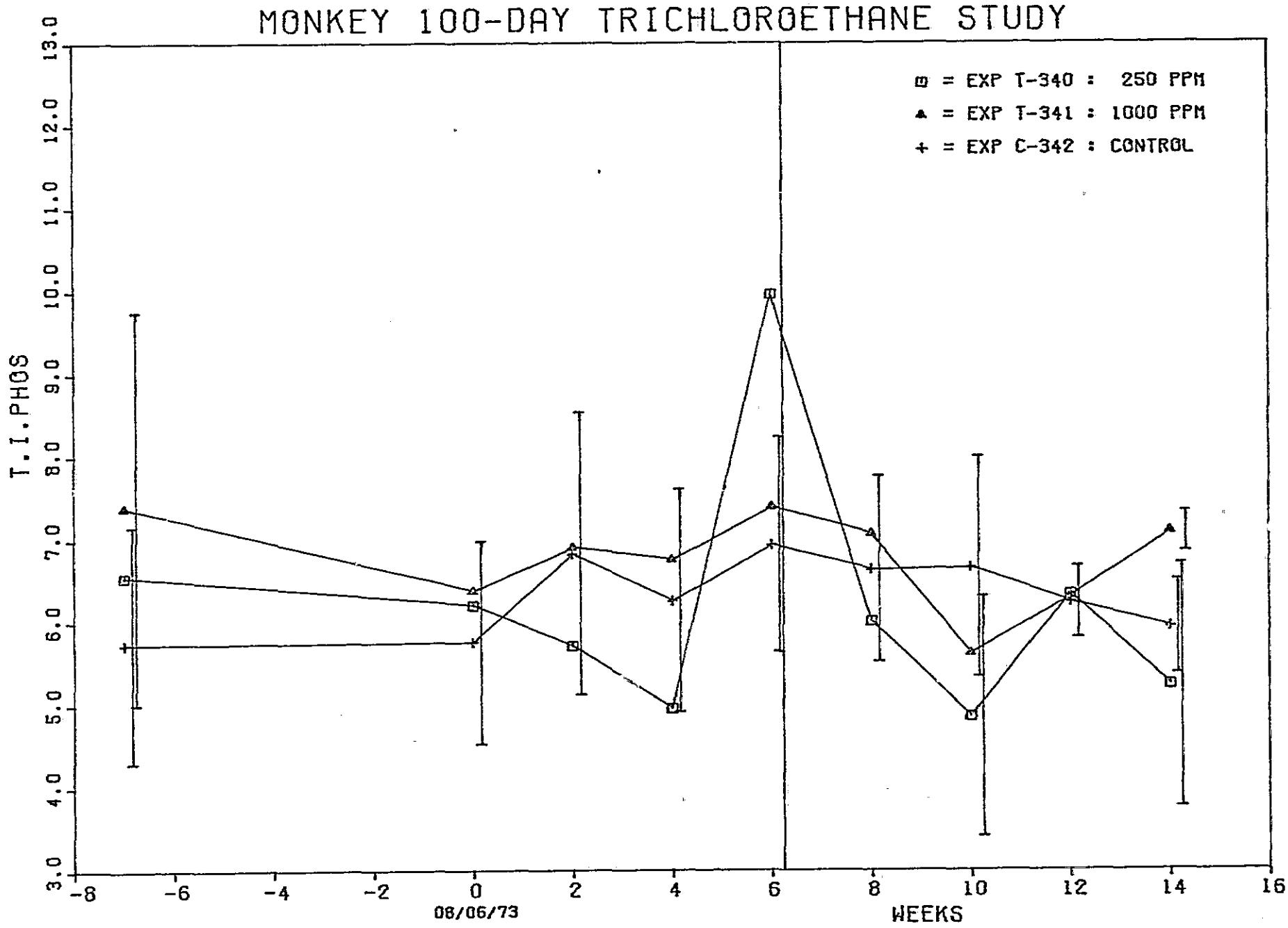

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
RETIC
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS


MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
△ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
SODIUM
144.0
146.0
148.0
150.0
152.0
154.0
156.0
158.0
160.0
162.0
164.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

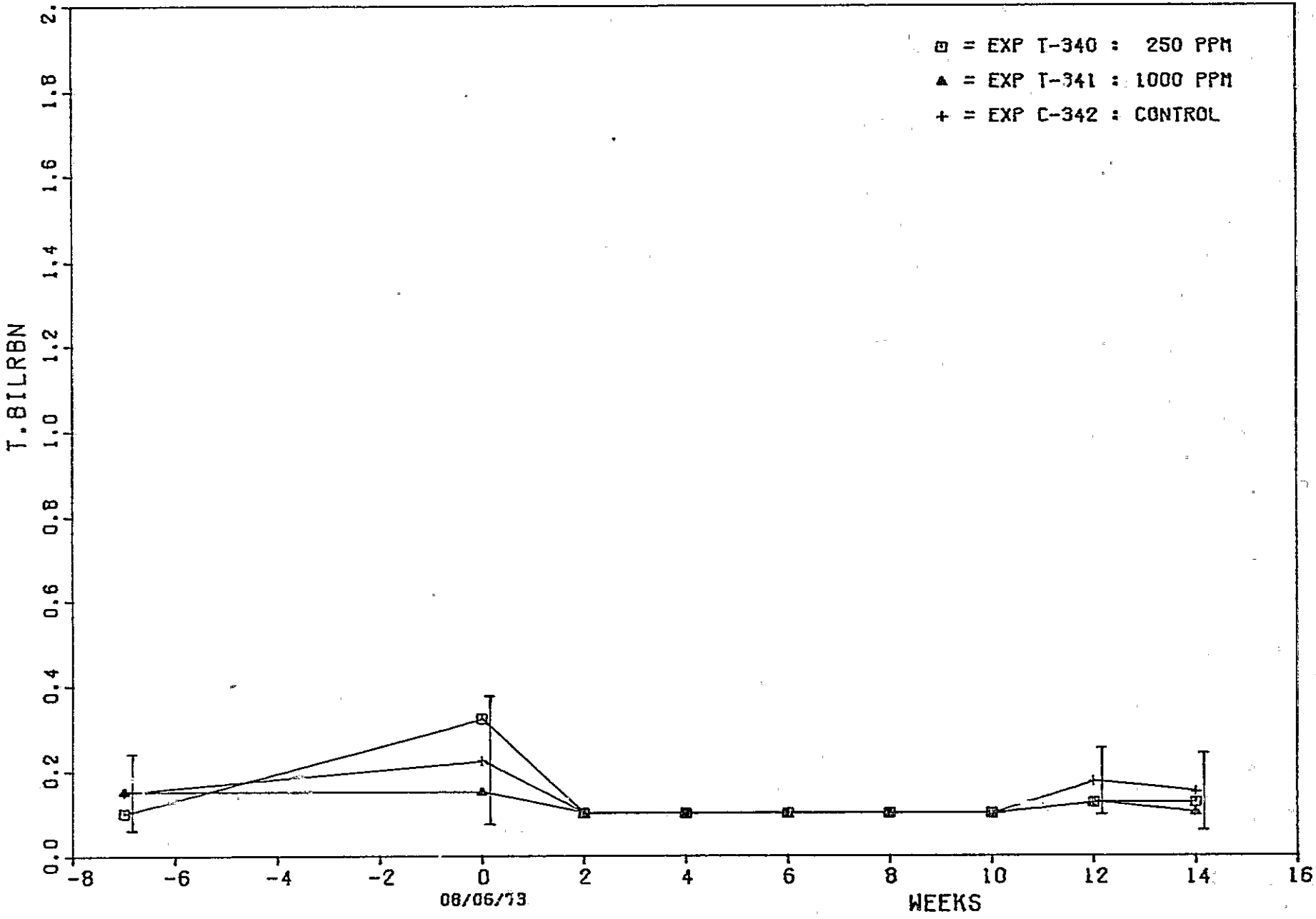

MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
△ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
POTASSM
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

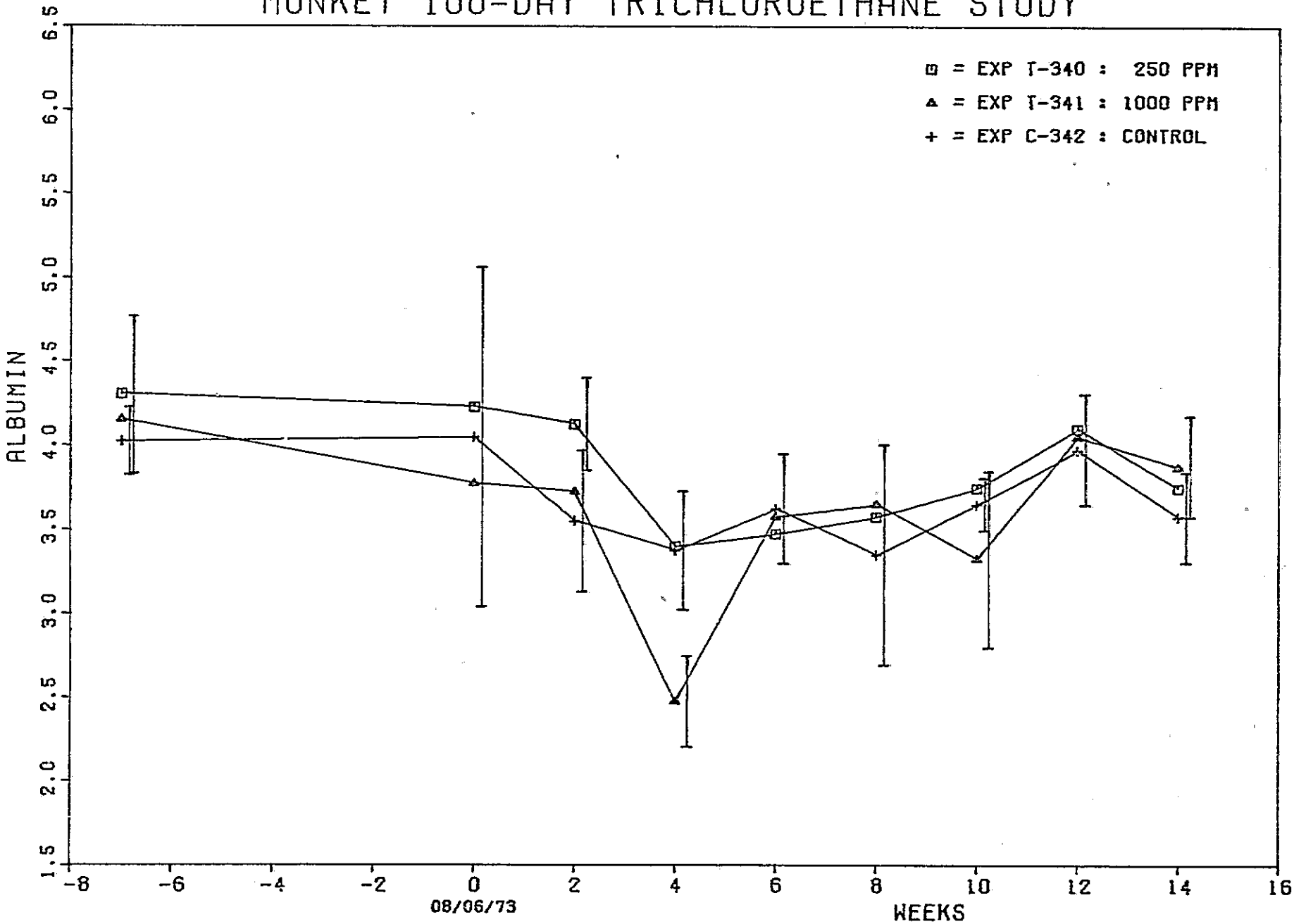

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
CHOLSTRL
320.0
300.0
280.0
260.0
240.0
220.0
200.0
180.0
160.0
140.0
120.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
06/06/73
WEEKS

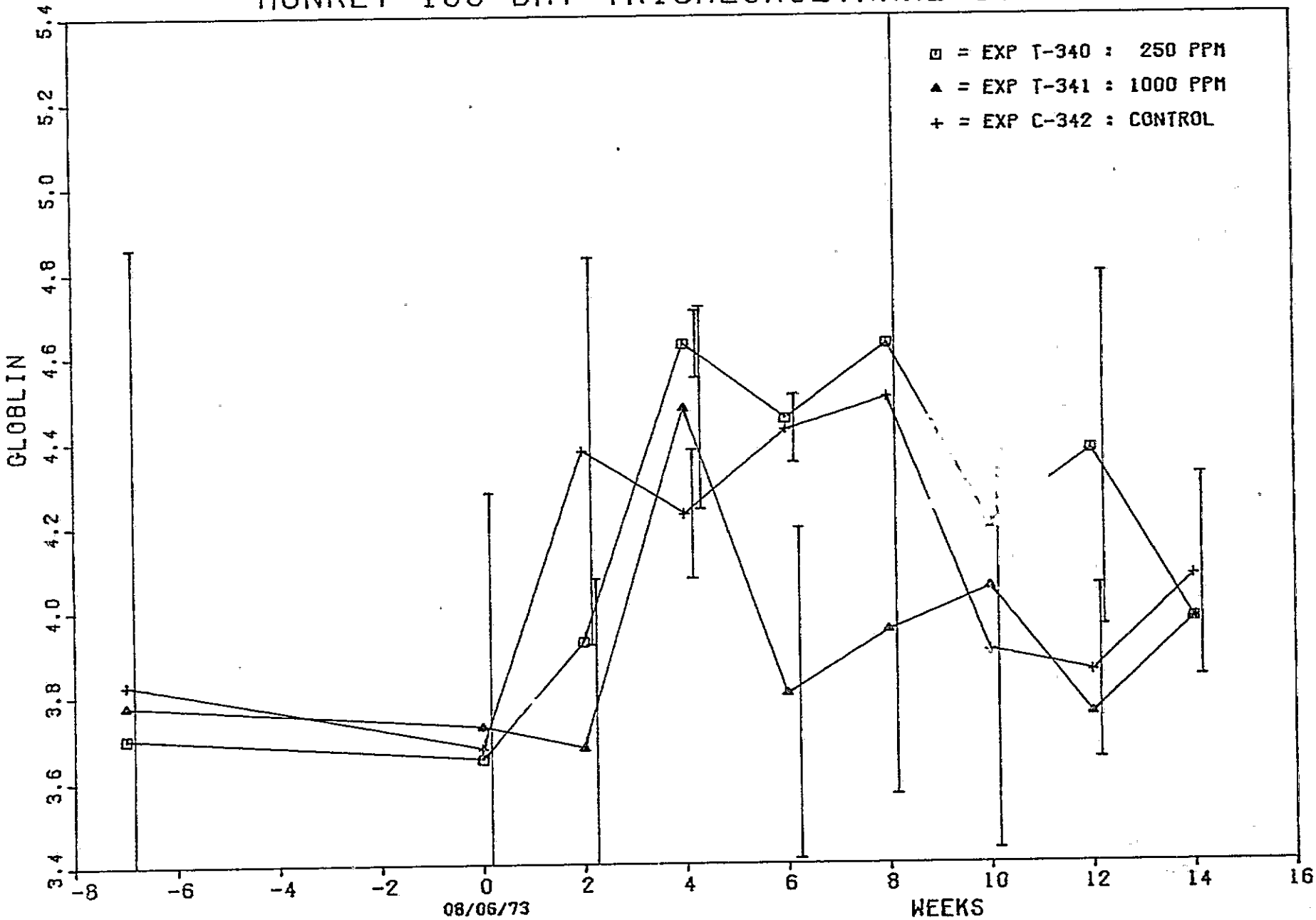

MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
CALCIUM
12.0
11.8
11.6
11.4
11.2
11.0
10.8
10.6
10.4
10.2
10.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
03/06/73
WEEKS

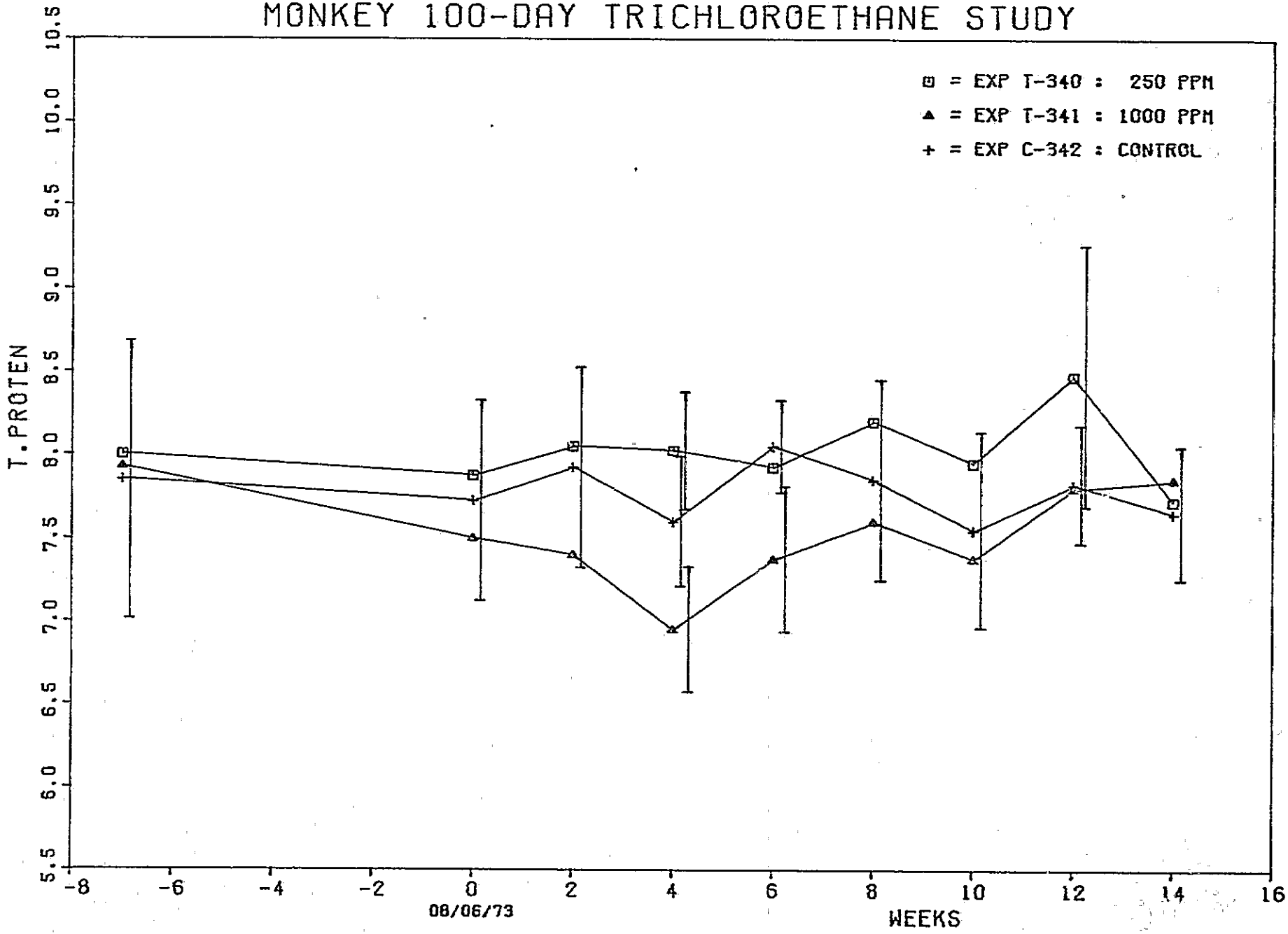

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
T.I.PHOS
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

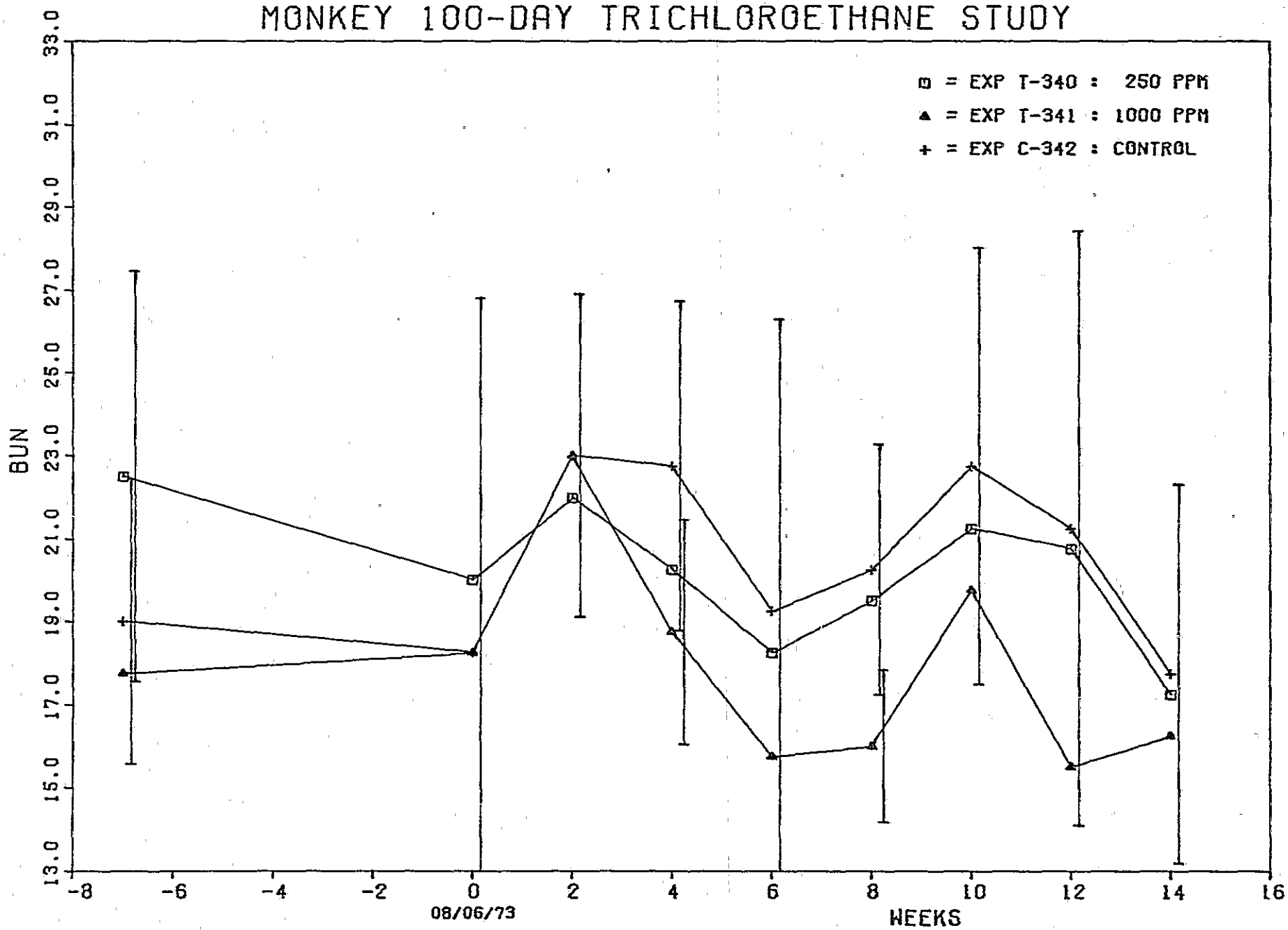
MONKEY 100-DAY TRICHLOROETHANE STUDY

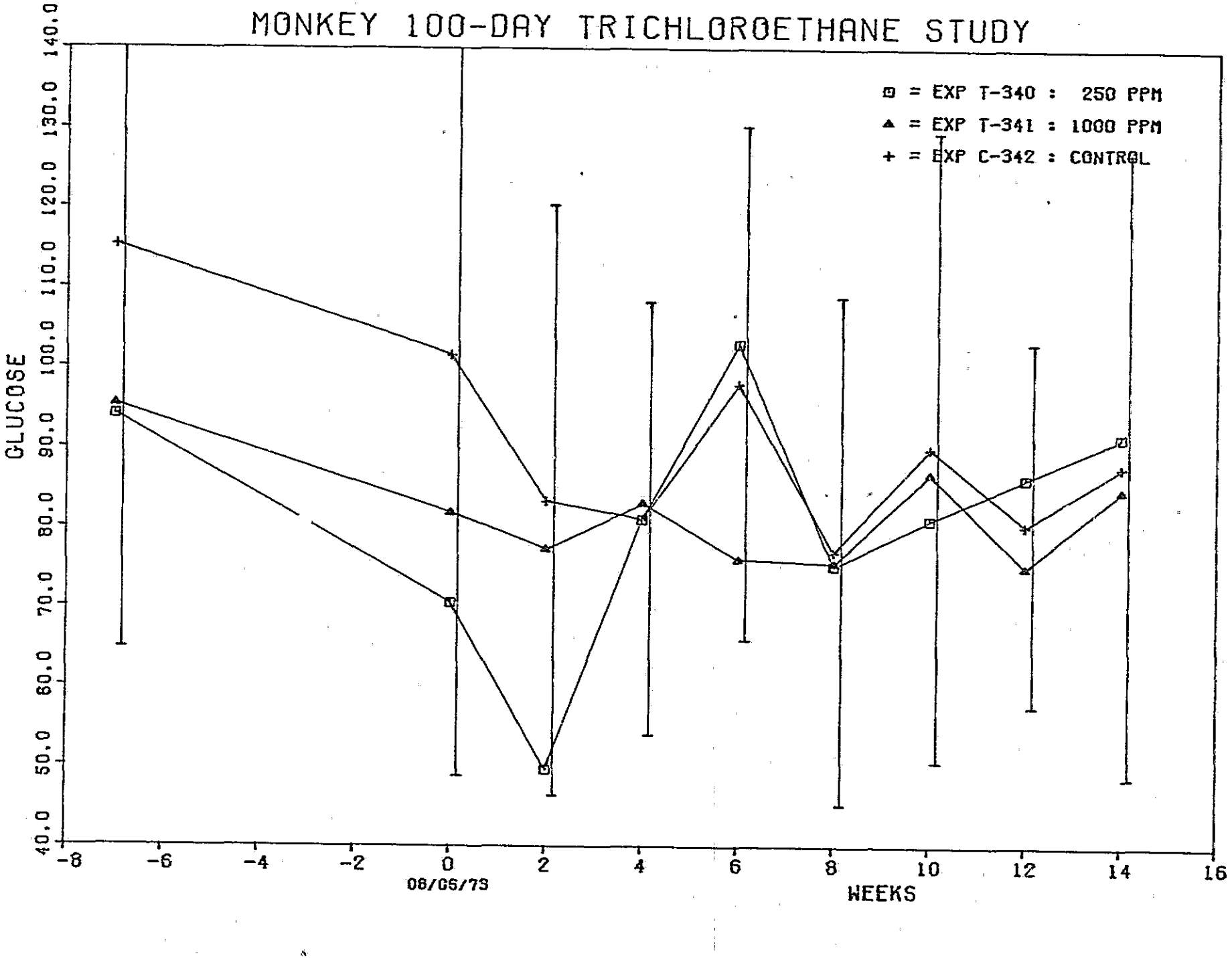


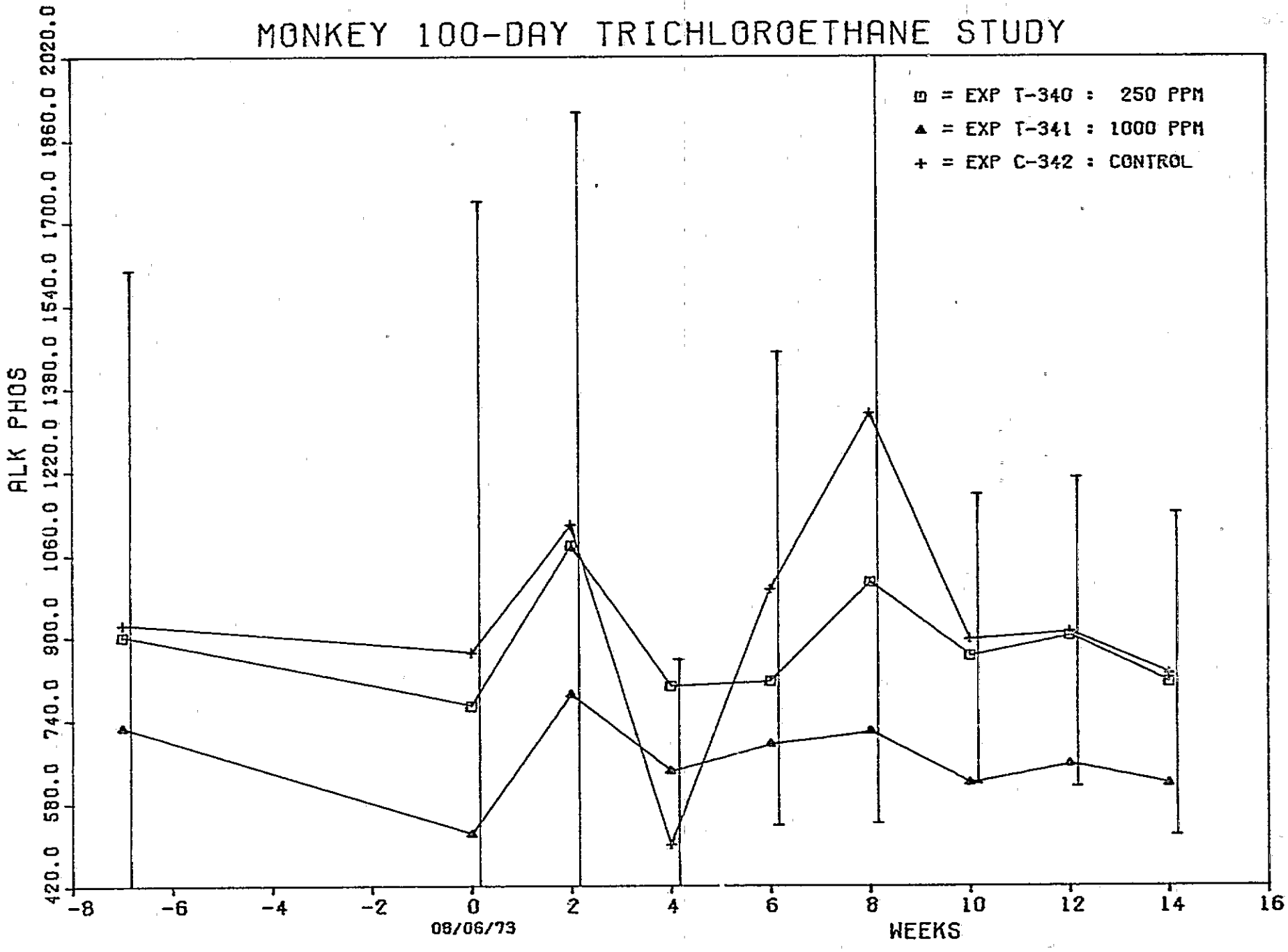

MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
△ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
ALBUMIN
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

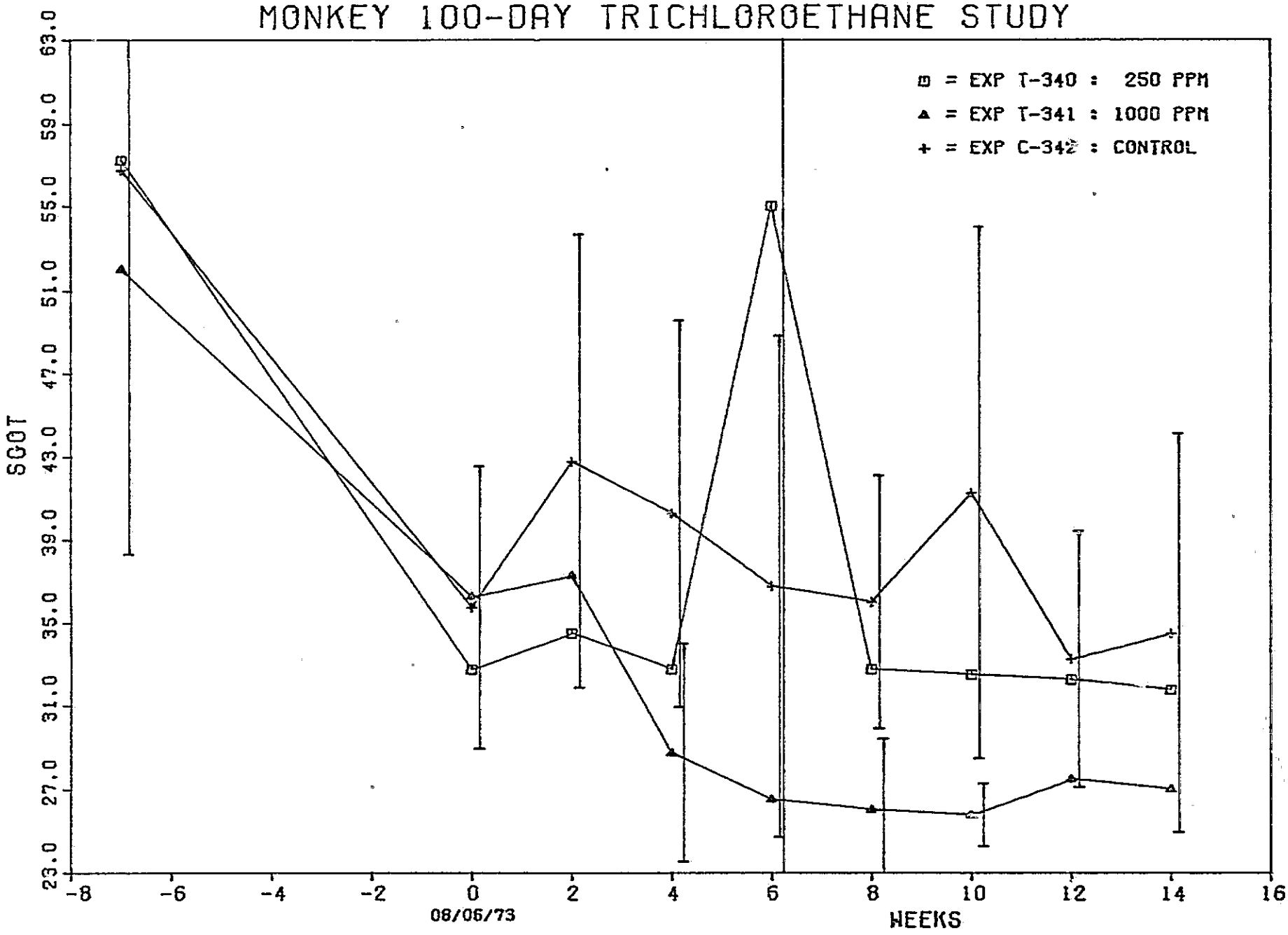

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
GLOBLIN
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

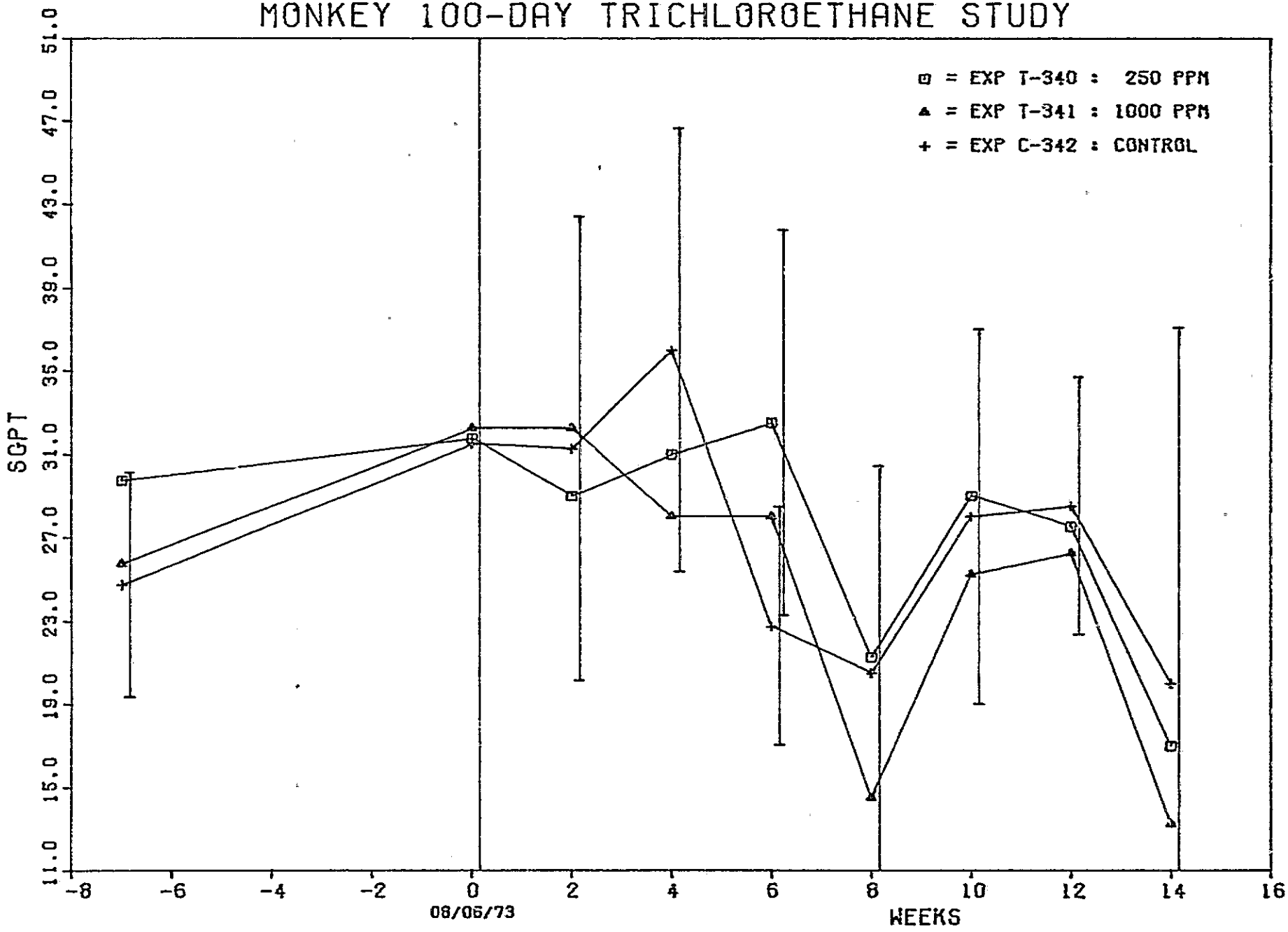

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
T.PROTEN
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

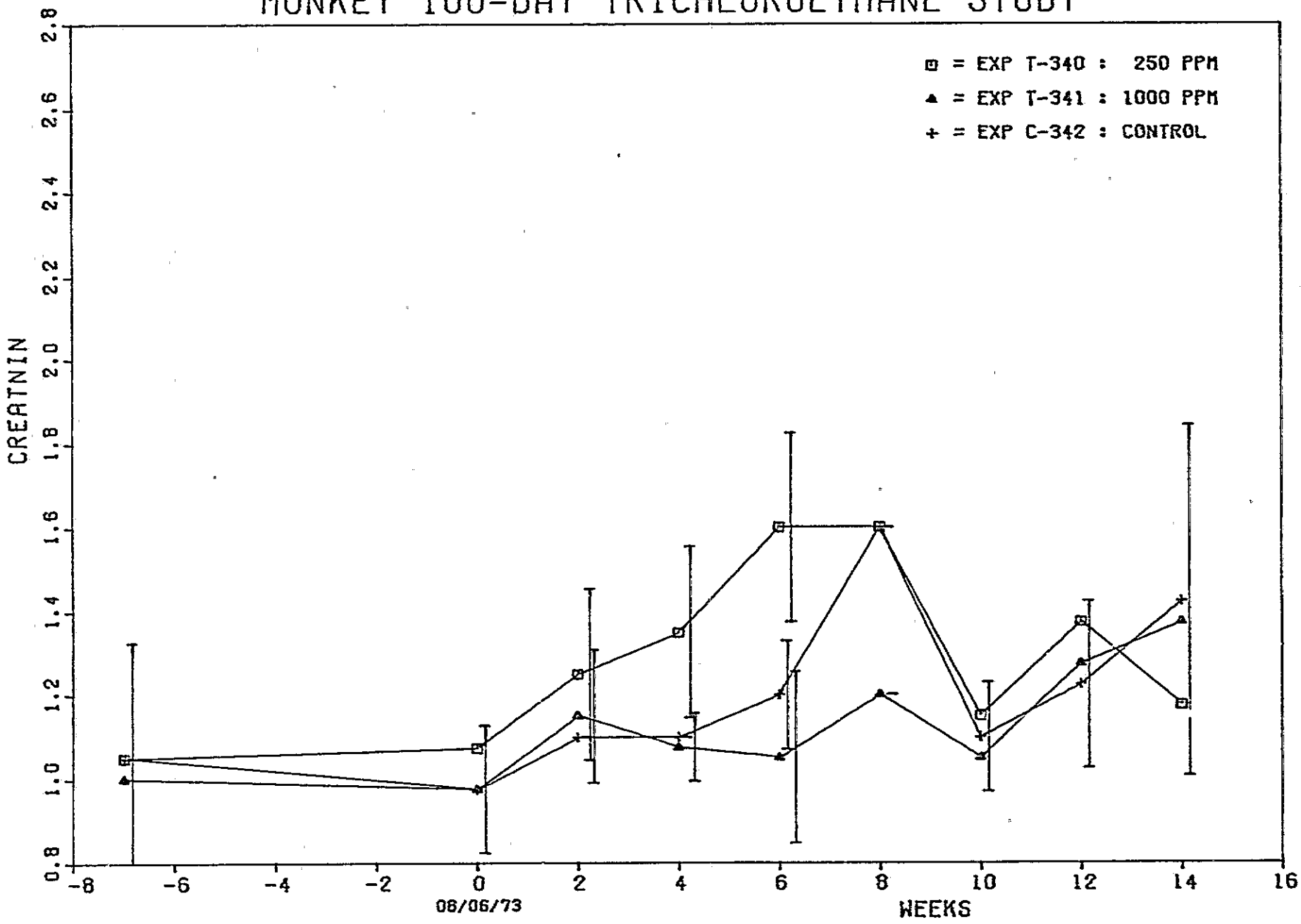

MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
BUN
33.0
31.0
29.0
27.0
25.0
23.0
21.0
19.0
17.0
15.0
13.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS

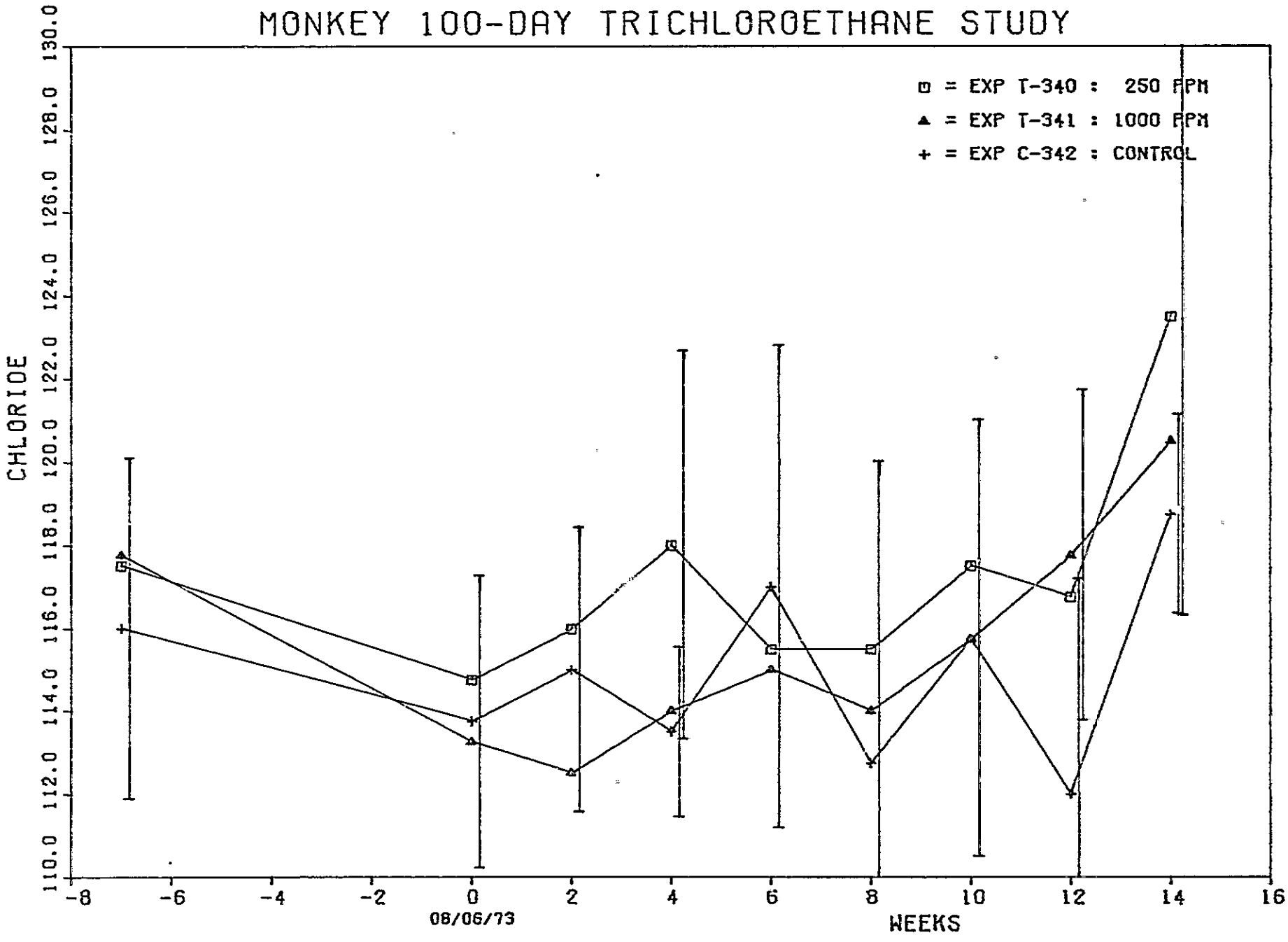

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
GLUCOSE
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/05/73
WEEKS

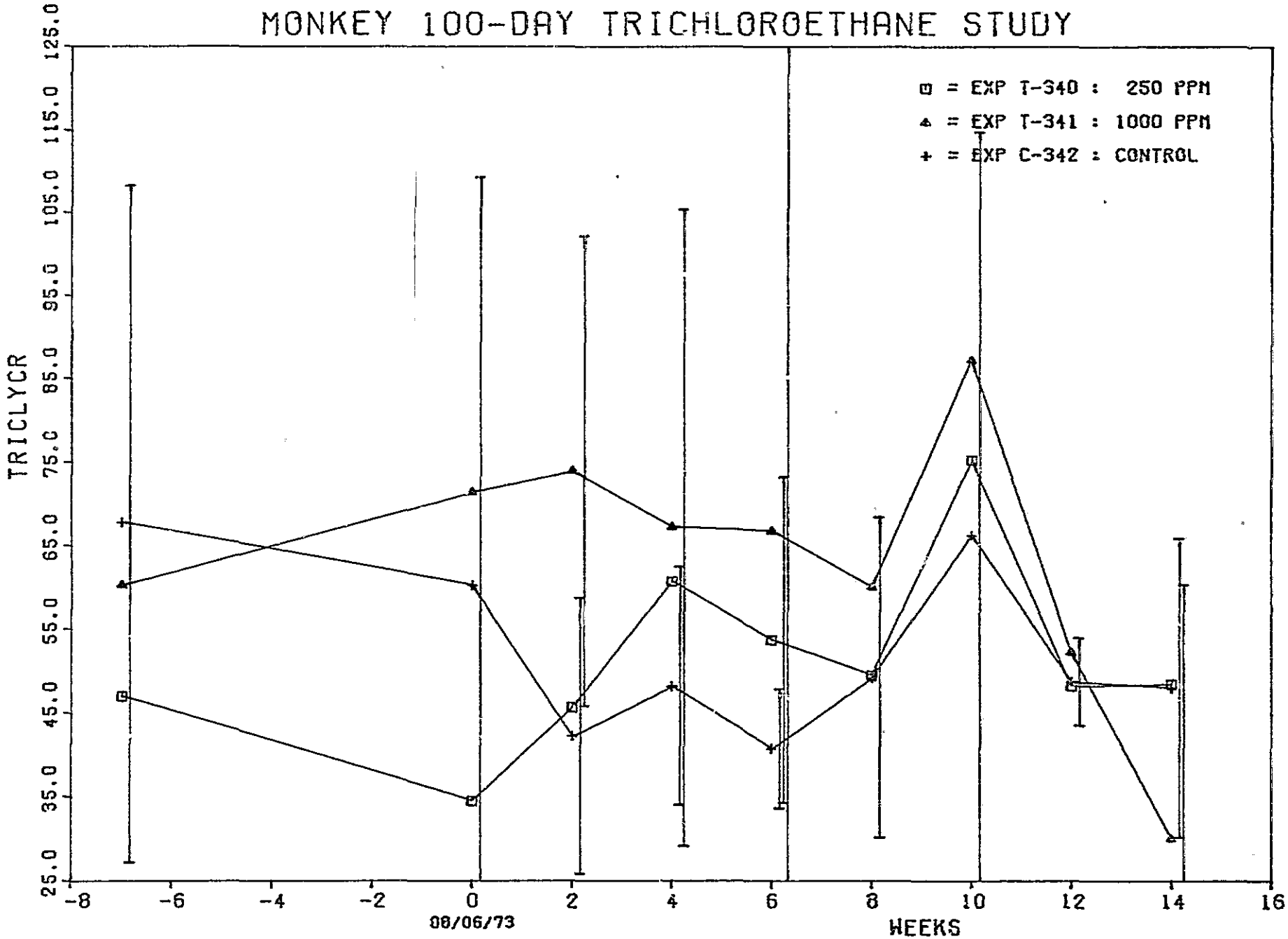

MONKEY 100-DAY TRICHLOROETHANE STUDY
⊡ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
ALK PHOS
420.0 580.0 740.0 900.0 1060.0 1220.0 1380.0 1540.0 1700.0 1860.0 2020.0
-8 -6 -4 -2 0 2 4 6 8 10 12 14 16
08/06/73
WEEKS

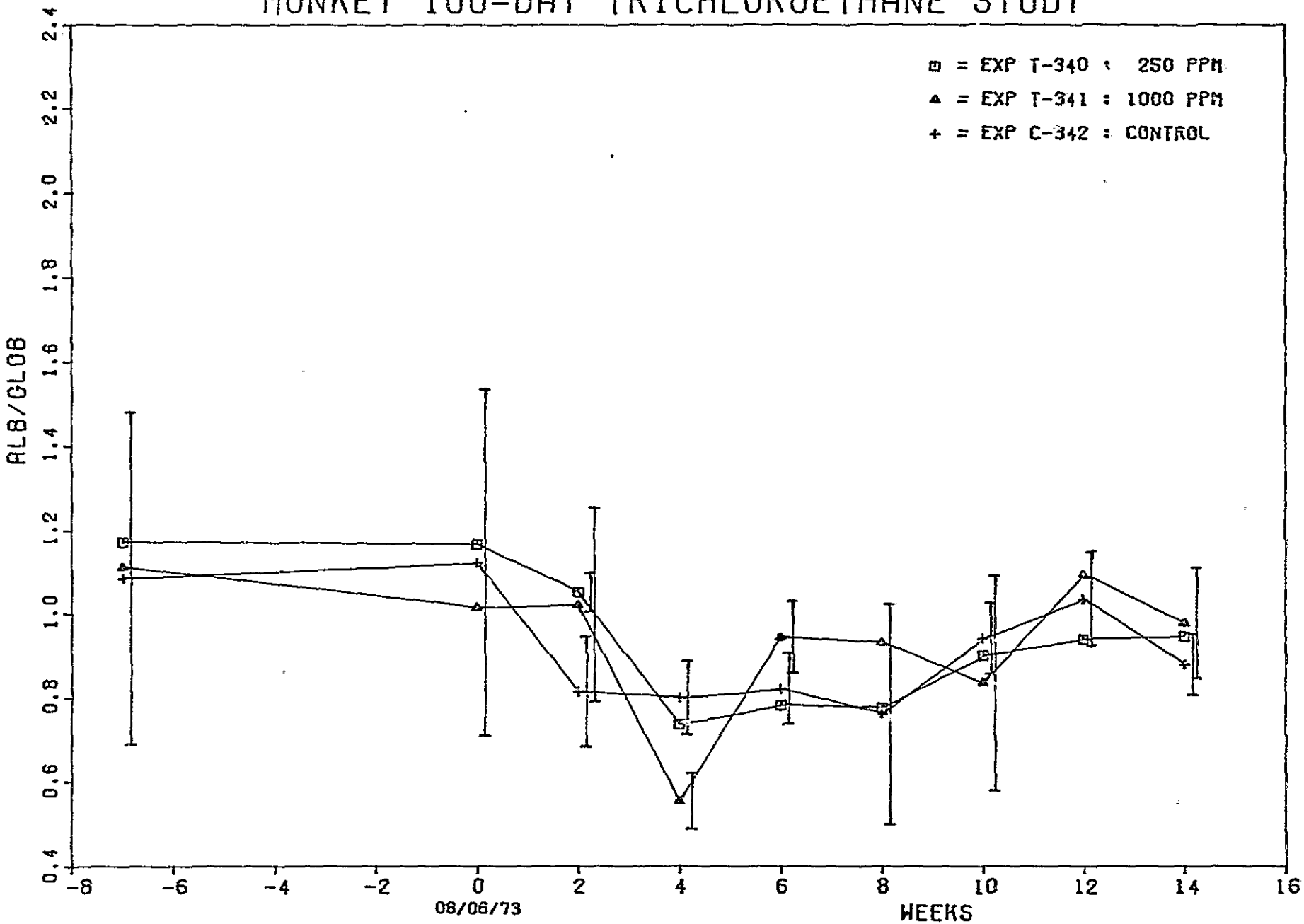

MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
SGOT
63.0
59.0
55.0
51.0
47.0
43.0
39.0
35.0
31.0
27.0
23.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS


MONKEY 100-DAY TRICHLOROETHANE STUDY
= EXP T-340 : 250 PPM
= EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
SGPT
11.0
15.0
19.0
23.0
27.0
31.0
35.0
39.0
43.0
47.0
51.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS


MONKEY 100-DAY TRICHLOROETHANE STUDY
= EXP T-340 : 250 PPM
= EXP T-341 : 1000 PPM
= EXP C-342 : CONTROL
CREATNIN
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS


MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
▲ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
CHLORIDE
110.0
112.0
114.0
116.0
118.0
120.0
122.0
124.0
126.0
128.0
130.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS


MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
△ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
TRICLYCR
125.0
115.0
105.0
95.0
85.0
75.0
65.0
55.0
45.0
35.0
25.0
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS


MONKEY 100-DAY TRICHLOROETHANE STUDY
□ = EXP T-340 : 250 PPM
△ = EXP T-341 : 1000 PPM
+ = EXP C-342 : CONTROL
ALB/GLOB
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
08/06/73
WEEKS