

Interoffice Communication

CONFIDENTIAL

To Tom Grumbles
From P. L. Fetzer
Date March 24, 1982
Subject Comparative Testing of Organic
Vapor Monitors 3M-#3500 & #3520

In each of the last three summers, extensive VCM exposure studies have been conducted in the Conoco VCM Plant Laboratory. These studies have examined charcoal tube/pump and passive dosimeter monitoring of vinyl chloride and ethylene dichloride exposures. Both standard gas and comparative field studies were completed the first year.

The later laboratory studies utilizing a wide concentration range of vinyl chloride standards were conducted primarily with the 3M Brand Organic Vapor Monitor #3500. The data obtained from these studies indicated that the capacity of the monitor towards vinyl chloride was dependent upon the standard concentration and the duration of the testing. The data also indicated that vinyl chloride readily desorbed from the monitor during the course of the testing.

During this time frame, 3M developed the dual wafer monitor, #3520, to improve the retention of the volatile organics. The literature describing the #3520 monitor and its sampling criterias stated the validity of the test can now be established by calculating the weight ratio of components found in the primary and secondary sections of the monitor. This ratio (W_s/W_p) must be 0.5 or less for the sample to be valid. 3M provided the VCM Plant with several monitors to conduct a field and laboratory study. The purpose of the study was to compare the results from the #3520 monitor to those from the #3500 monitor in actual field use and in a control laboratory study. Manpower limitations delayed the completion of this study for several months.

- The field study portion included personnel testing during the initial shutdown phase of a plant maintenance turnaround, vinyl chloride tank car loading operations and miscellaneous work functions during normal plant operations. These data are summarized in Table I.

During the field study seven valid samples, according to W_s/W_p ratio, were obtained on the twenty-five testings conducted. In examining the field study data, it is interesting to note that in the presence of ethylene dichloride (EDC), more vinyl is found on the secondary wafer than on the primary. Little or no EDC was ever found on the secondary wafer as indicated by the W_s/W_p ratio.

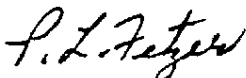
The vinyl chloride concentration shown for the two monitors agreed within 0.1 ppm on 14 of 25 samples. Only 4 of the 12 turnaround maintenance samples were in this group. The data appears to indicate that EDC displaced the vinyl chloride component from the primary badge back to the atmosphere in the #3500 monitor and onto the secondary section in the #3520 monitor.

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The data for the standards study conducted in the laboratory are shown in Table II and graphically represented in Figure I for vinyl chloride and in Figure II for EDC. These data substantiate the observation made from the field data concerning EDC in that it remains on the primary absorbent wafer. Our standards data for vinyl chloride supports the study conducted by 3M and shows how rapidly the vinyl chloride is transferred to the secondary absorbent or eliminated to the atmosphere.

This study indicates that for a combined gas, 8.20 ppm mole vinyl chloride and 9.8 ppm mole EDC, the #3520 provides a valid sample for at least 6 hours, Figure I. It appears that the single badge, #3500, began losing the vinyl chloride almost immediately when compared to the corrected value for the #3520 dual wafer badge.

Additional work will be required with lower concentration standards to determine where it becomes practical to use the #3520 monitor in place of the #3500 monitor.



P. L. Fetzner

kf

CC: SRA-JAD-RB-JWW-J. Hall

SAL 000048090

TABLE 1
FIELD STUDY COMPARISON
3-M #3500 AND #3520 BADGES
VINYL CHLORIDE AND ETHYLENE DICHLORIDE

Sample No.	Sample Time-Min.	PPM VCM			PPM EDC		
		#3500	#3520	$\frac{W_s}{W_D}$	#3500	#3520	$\frac{W_s}{W_D}$
a	500	0.33	0.89	1.08	3.11	3.74	0
b	475	0.06	0.89	1.47	3.00	3.79	0
c	465	0.07	0.13	0.84	22.66	24.25	0
d	465	0.23	0.27	0.33	7.81	8.72	0
e	480	0.04	0.13	1.48	17.17	16.79	0
f	490	0.26	0.59	0.78	31.71	31.79	0
g	450	0.14	0.45	1.12	11.57	11.96	0
h	450	0.06	0.19	1.61	9.70	9.54	0
i	440	0.17	0.62	1.59	46.38	23.80	0
j	440	0.06	0.25	2.47	100.40	20.58	0.01
k	480	0.05	0.10	1.18	13.20	13.89	0
l	480	0.03	0.07	1.80	5.08	4.78	0
m	445	N.D.	N.D.		N.D.	N.D.	
n	450	N.D.	N.D.		N.D.	N.D.	
o	420	0.21	2.34	9.95	N.D.	N.D.	
p	470	N.D.	0.11	0	N.D.	N.D.	
q	410	0.14	0.21	0.65	1.10	1.00	0
r	495	<0.01	0.16	0	0.36	0.44	0
s	450	0.09	0.15	0.16	0.17	0.23	0
t	470	0.04	0.04	0.33	N.D.	N.D.	
u	450	0.01	0.01	0	0.40	0.37	0
v	450	0.02	0.06	0.67	0.13	0.49	0.81
w	480	0.02	0.04	1.09	1.57	1.37	0
x	490	0.04	0.05	0.46	1.93	6.17	0
y	450	0.04	0.07	0.53	0.81	0.91	0

N.D. - Not Detected

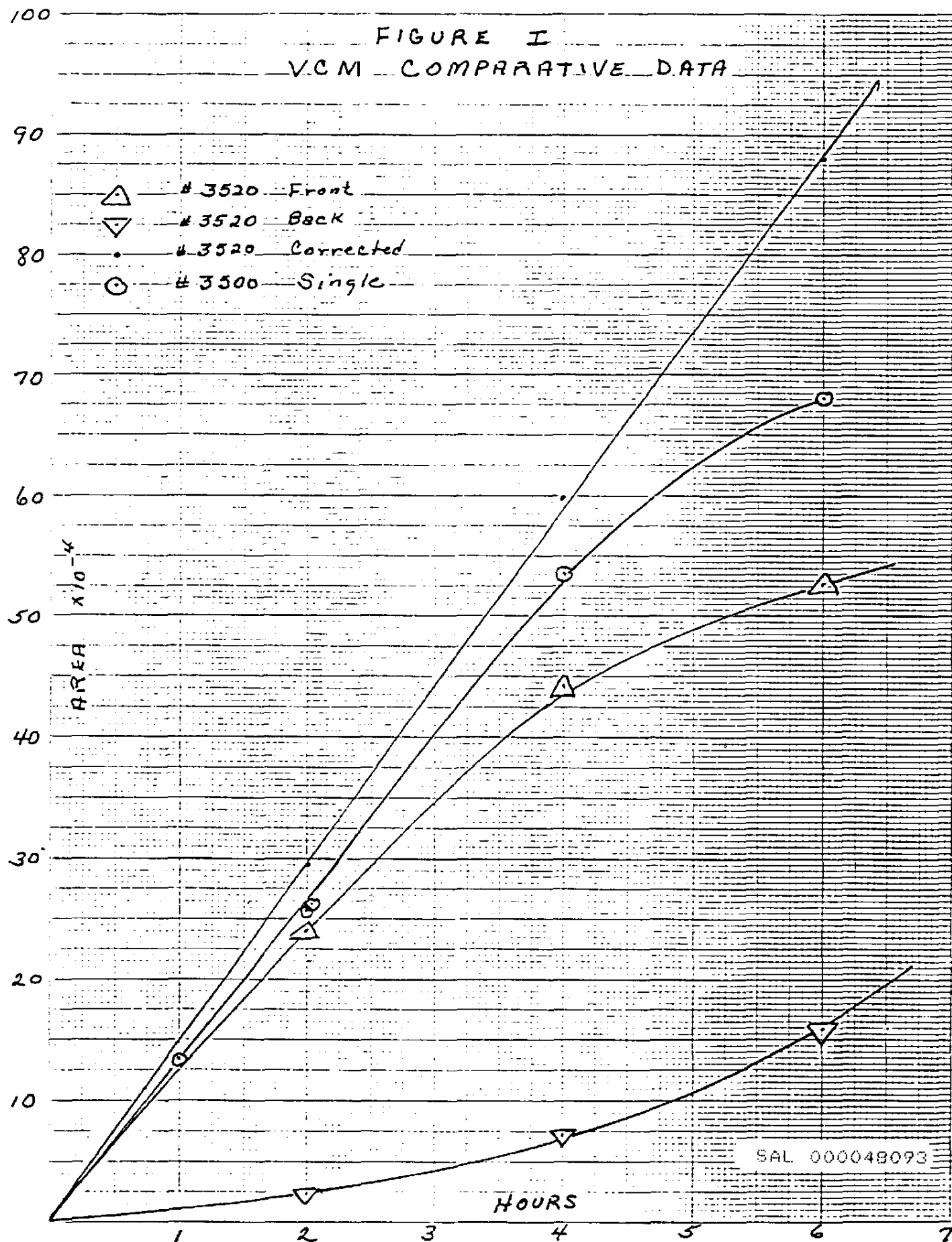
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TABLE II
LABORATORY STUDY COMPARISON
VINYL CHLORIDE AND ETHYLENE DICHLORIDE STANDARDS
3M #3500 AND #3520 BADGES

<u>Time Samples</u>	<u>VCN AREA</u>					<u>EDC AREA</u>				
	<u>#3500</u>	<u>#3520</u>				<u>#3500</u>	<u>#3520</u>			
	<u>Single</u>	<u>Front</u>	<u>Back</u>	<u>Correct Total</u>	<u>Ws/ Wp</u>	<u>Single</u>	<u>Front</u>	<u>Back</u>	<u>Corrected Total</u>	<u>Ws W</u>
360	666,271	527,397	159,306	879,470	.30	75,307	72,628	0	72,628	0
240	530,436	442,349	71,324	599,262	.16	55,654	51,749	0	51,749	0
125	27,990									
'20	257,706	241,421	23,974	294,163	.10	26,302	24,638	-	24,638	0
60	134,303					13,540				

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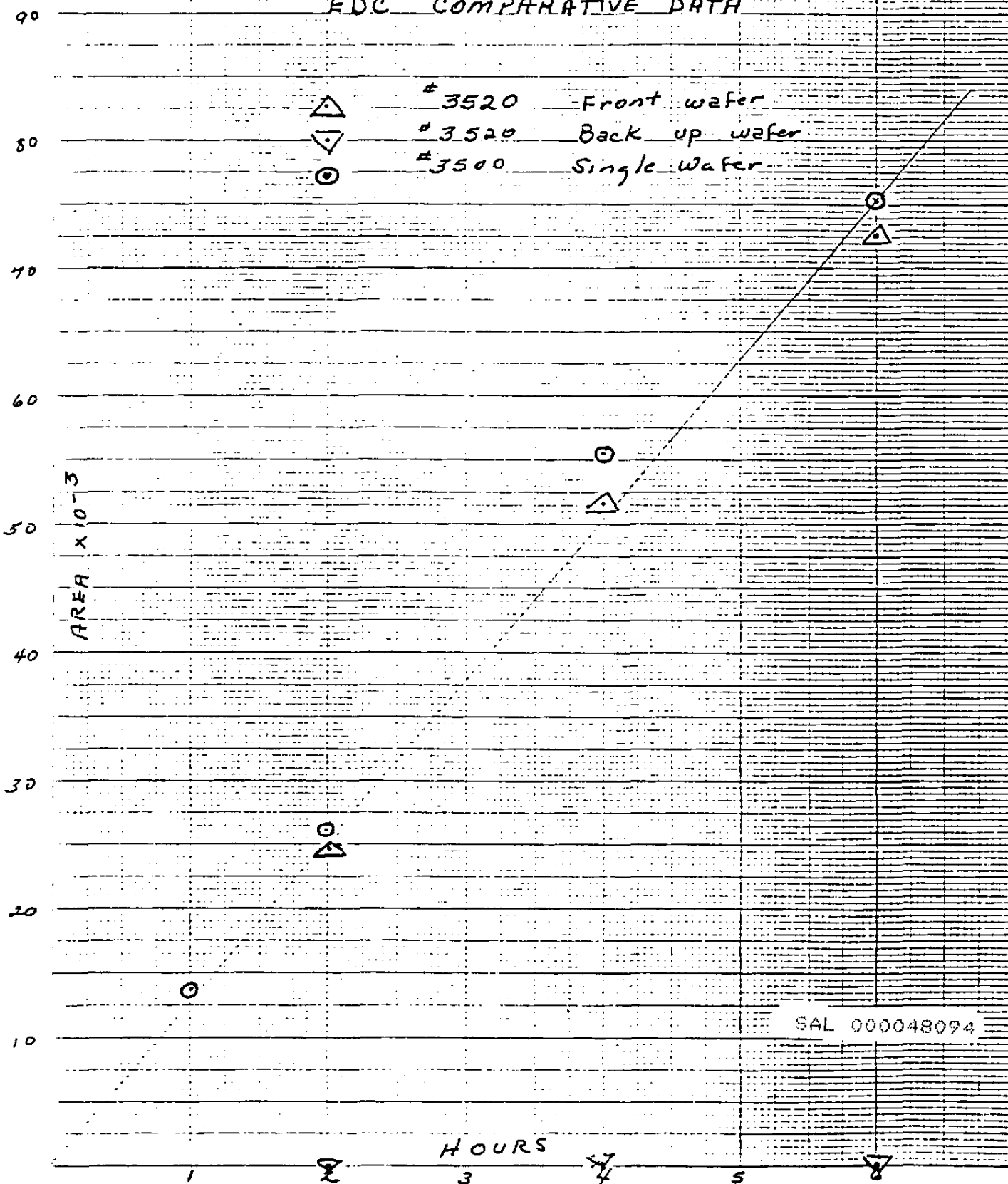
FIGURE I
VCM COMPARATIVE DATA



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FIGURE II

FDC COMPARATIVE DATA





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This study indicates that for a combined gas, 8.20 ppm mole vinyl chloride and 9.8 ppm mole EDC, the #3520 provides a valid sample for at least 6 hours, Figure I. It appears that the single badge, #3500, began losing the vinyl chloride almost immediately when compared to the corrected value for the #3520 dual wafer badge.

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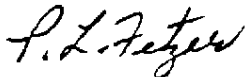
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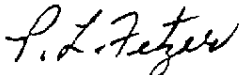
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x	490	0.04	0.05	0.46	1.93	6.17	0
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r	435	< 0.01	0.16	0	0.36	0.44	0
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3M #3500 AND #3520 BADGES

<u>Time Samples</u>	<u>VCM AREA</u>					<u>EDC AREA</u>				
	<u>#3500</u>	<u>#3520</u>				<u>#3500</u>	<u>#3520</u>			
	<u>Single</u>	<u>Front</u>	<u>Back</u>	<u>Correct Total</u>	<u>Ws/ Wp</u>	<u>Single</u>	<u>Front</u>	<u>Back</u>	<u>Corrected Total</u>	<u>Ws w</u>
360	666,271	527,897	159,806	879,470	.30	75,307	72,628	0	72,628	0
240	530,436	442,349	71,324	599,262	.16	55,654	51,749	0	51,749	0
125	27,990									
120	257,706	241,421	23,974	294,163	.10	26,302	24,638	-	24,638	0
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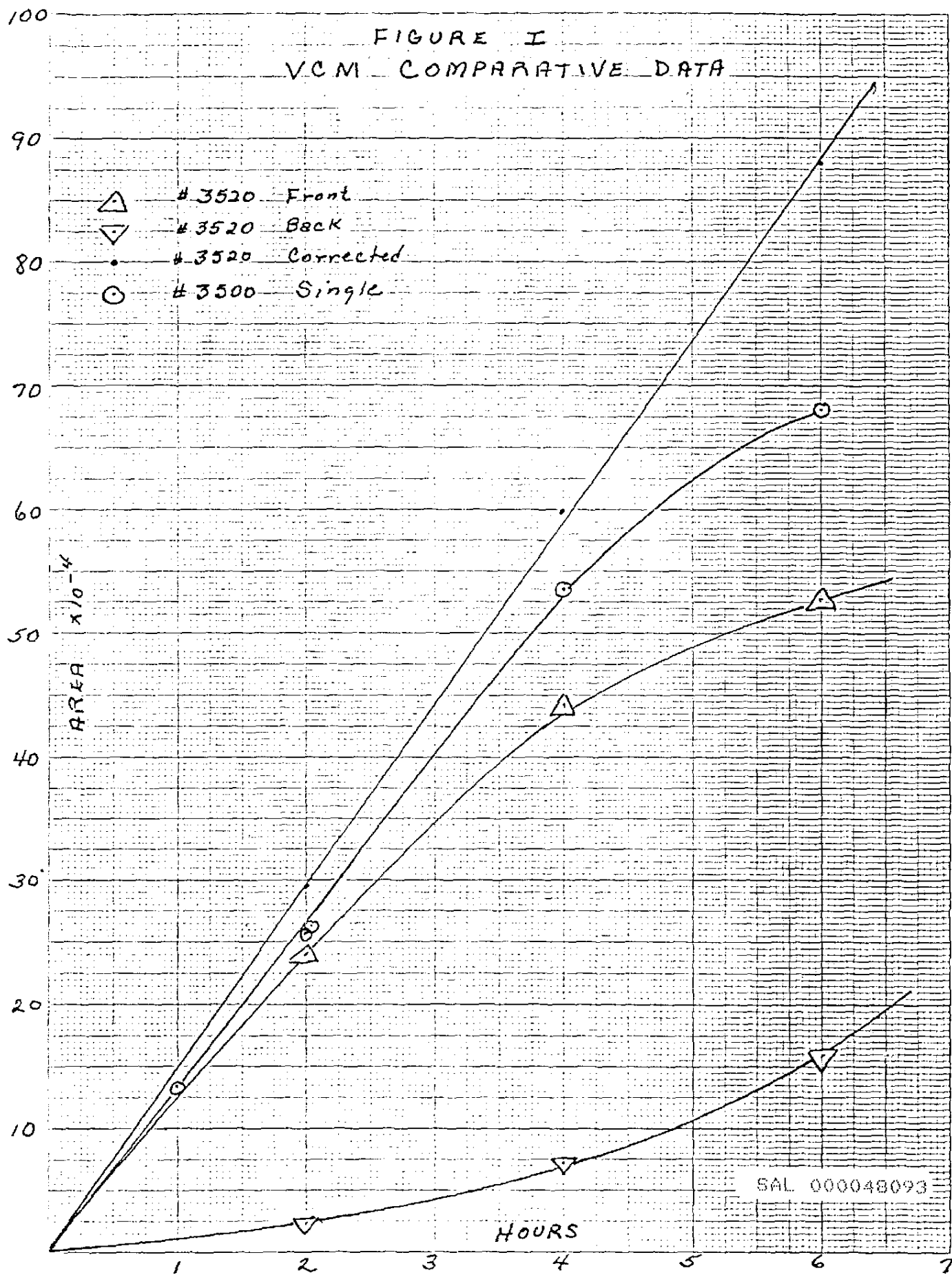
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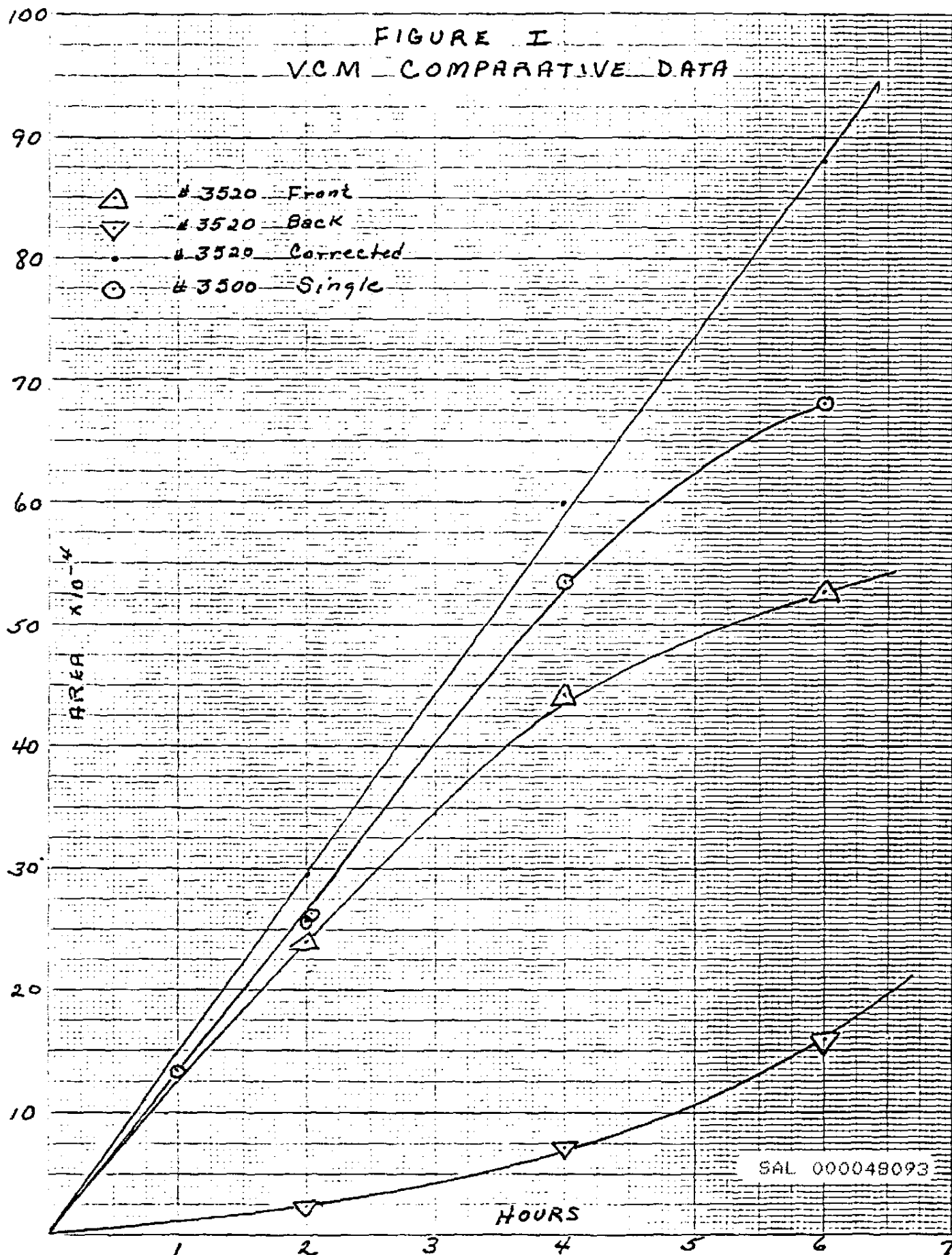
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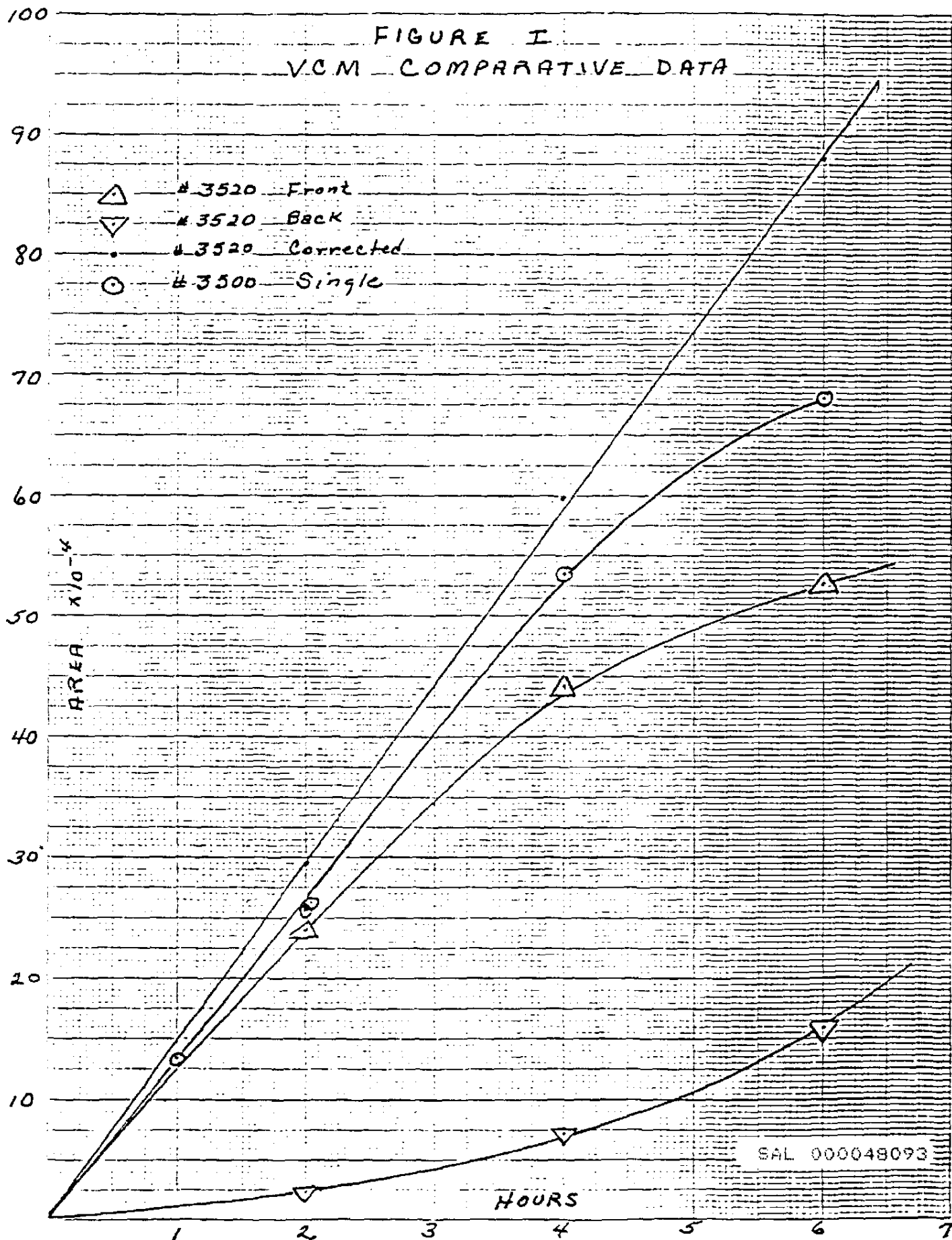
FIGURE I
VCM COMPARATIVE DATA



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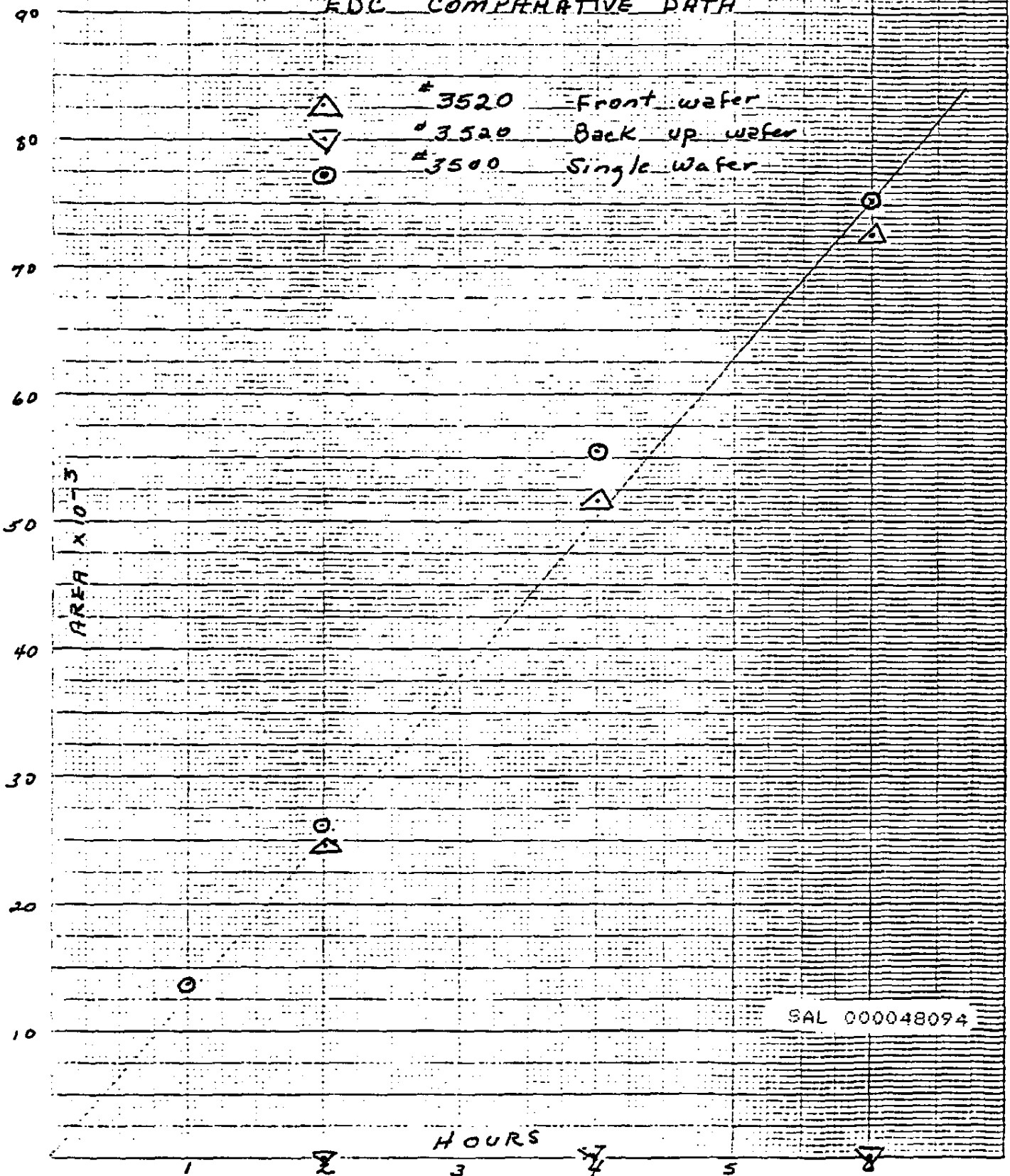
100 90 80 70 60 50 40 30 20 10 0
 AREA $\times 10^{-4}$

1 2 3 4 5 6 7
 HOURS

SAL 000048093

FIGURE II

EDC COMPARATIVE DATA



SAL 000048094

FIGURE II

FDC COMPARATIVE DATA

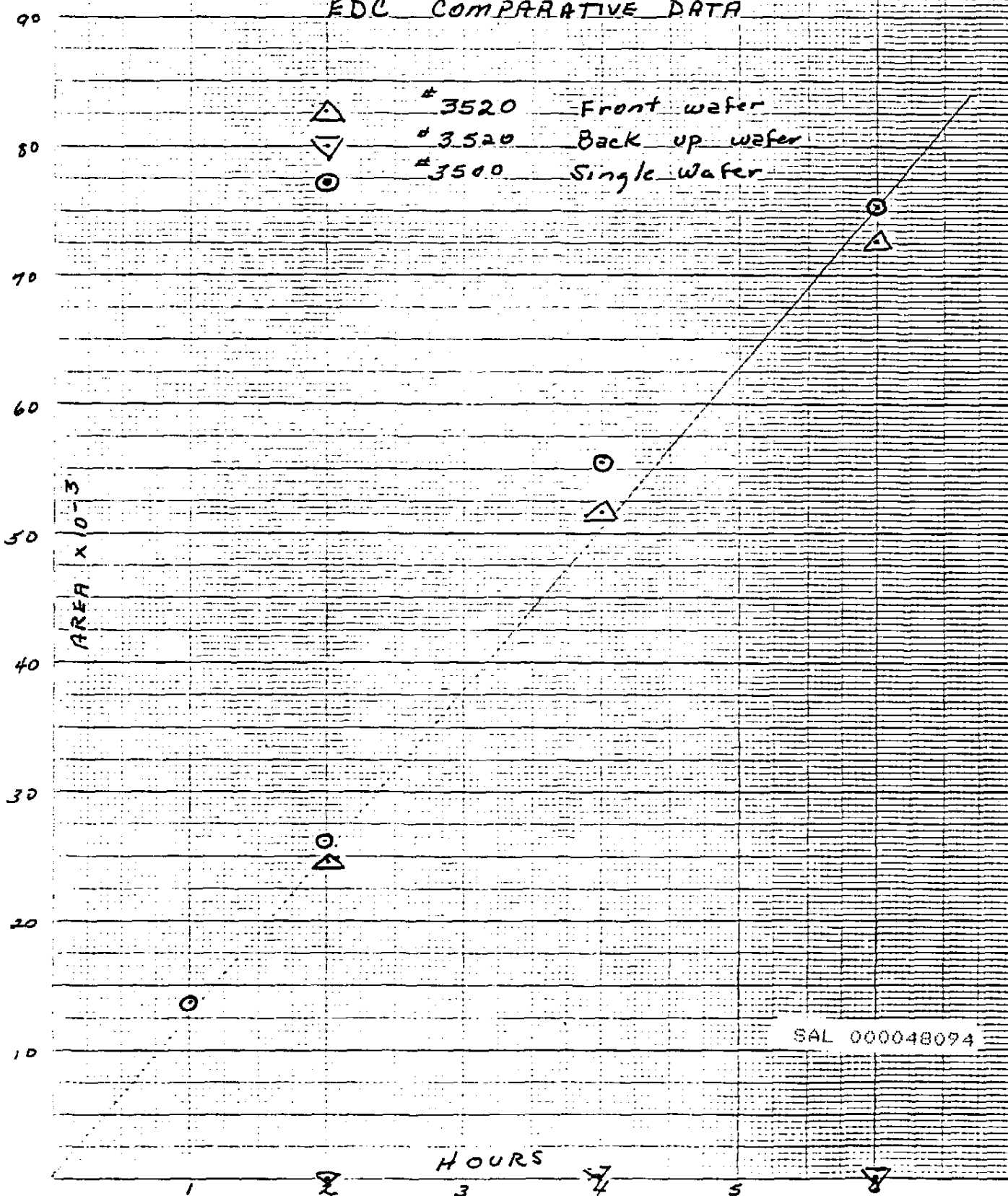
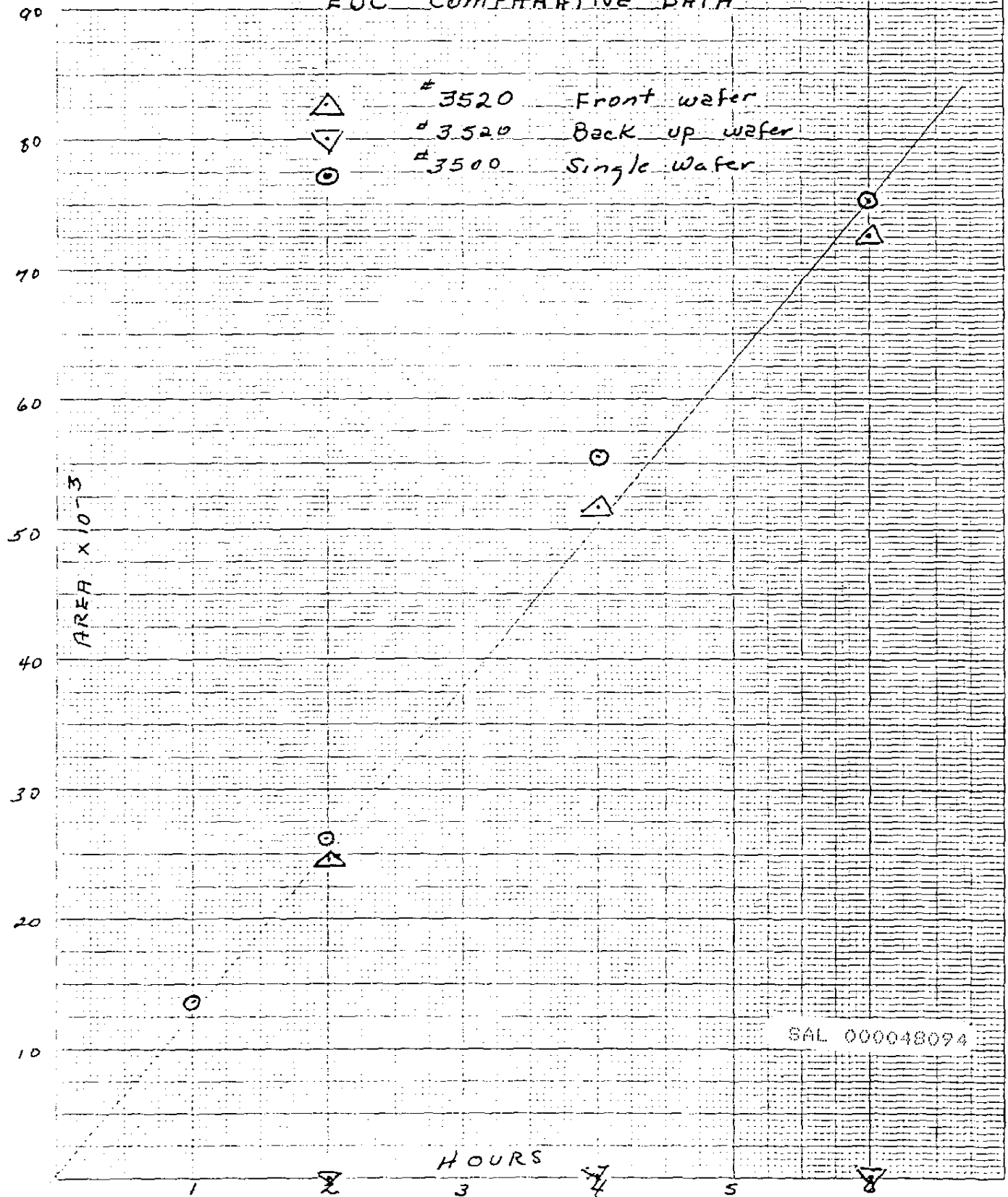


FIGURE II

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