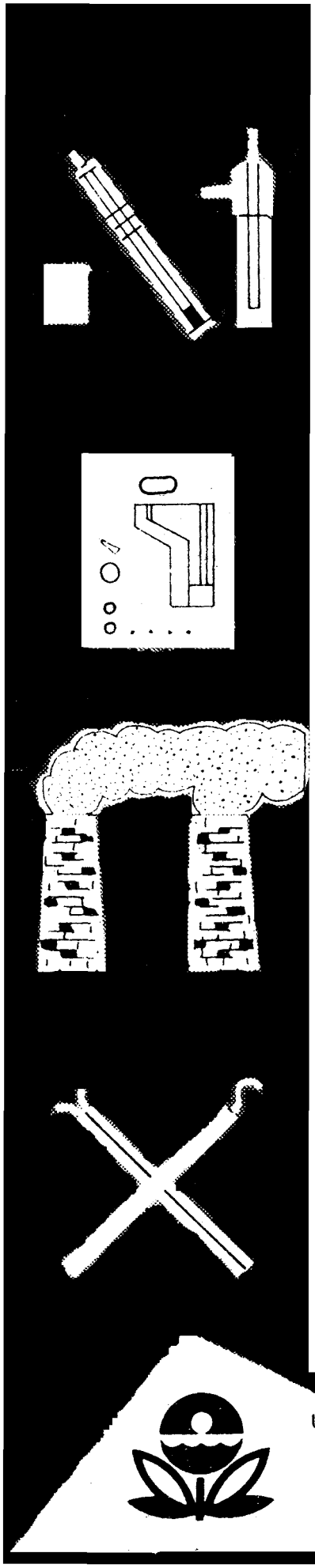
EMB Report No. 78-OCM-12B
October 1980



AIR POLLUTION EMISSION TEST

EMISSION TEST REPORT

BENZENE

FUGITIVE EMISSIONS
PETROLEUM REFINERIES

Sun Petroleum Products Company
Toledo, Ohio

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

EMB REPORT NO. 78-OCM-12B

EMISSION TEST REPORT

BENZENE

Fugitive Emissions - Petroleum Refineries

Sun Petroleum Products Company

Toledo, Ohio

October 1980

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	SUMMARY OF RESULTS	2
III.	PROCESS DESCRIPTION	9
IV.	SAMPLING AND ANALYTILCAL PROCEDURES	10

Appendix

A - Laboratory Report

B - Field Data Sheets

C - Test Log

D - ARCAS Vendor Information for the Fixed Monitoring System

I. INTRODUCTION

Under the Clean Air Act, as amended, the Environmental Protection Agency is required to develop national emission standards for those air pollutants which have been found to cause adverse health effects. Benzene has been listed by EPA as a hazardous air pollutant, and therefore EPA is currently developing an emission standard for benzene emissions for fugitive emissions, such as leaks from pump seals, valve seals, drains, etc., for all processes which produce benzene as a finished product, use benzene in the production of other organic chemicals, or produce benzene or benzene-containing streams in the manufacture of organic chemicals. Testing was conducted at this facility to develop data for this study.

Testing was performed at Sun Oil Company's Toledo Refinery, Toledo, Ohio, during November 13-17, 1978, by Emission Standards and Engineering Division, EPA and Engineering Science, Inc. personnel.

Individual component surveys were conducted using a portable VOC analyzer. Local VOC concentrations were measured and recorded at the surface of each potential leak interface. Comparative tests using the same type portable analyzer were conducted by Sun Oil Company personnel and the results were recorded on the EPA test data sheets. The results of these tests were used to compute the frequency of leak occurrence based on different concentration-limit criteria.

Also, data were collected so that the component survey results could be used as a basis for comparing the leak-identification effectiveness of unit area walkthroughs and an area monitoring system installed in one unit at this facility.

Finally, grab samples of emissions from detected leak sources along with the liquid handled by that source were collected for chromatographic analysis.

The major purpose for this analysis was to determine the relative benzene proportions in vapor versus liquids at leak sources.

II. SUMMARY OF RESULTS

The individual component surveys were performed by an EPA test crew followed immediately by a Sun Oil Company test crew. The results of the surveys are summarized in Tables II-1 to II-3. Data are presented for each unit surveyed as well as for the total equipment tested at the refinery. The EPA and Sun results are presented separately for comparative purposes.

For an additional test procedure comparison, the data were analyzed to determine for specified concentration ranges the reproducibility of results. This analysis is summarized in Table II-4. It can be observed that in 6 of 43 cases (or 14 percent of readings), the results were different for VOC >10000 ppm. These data points are listed in Table II-4. There are two possible causes for differences. First, lower results by team B could have been caused by a small leak in the instrument probe system. However, since the different data points are distributed throughout the survey time, and other data points immediately before and after do not show comparable differences, a leak is not probable. The most probable cause is that the indicated emissions were either variable or very localized (indicative of small leaks), and minor variations in timing or probe placement can cause a different concentration result.

The results of chromatographic analyses of vapor and liquid samples are presented in detail in Appendix A. The results for benzene distribution in vapor leak versus liquid source in weight percent are summarized in Table II-5. The weight percent benzene in vapor samples has been calculated on an air-free basis to allow consistent comparisons to the organic liquid benzene content.

The results of the walkthrough surveys are presented in Appendix B. These data will be analyzed in a separate report. Data on the unit 9-4 area monitoring system were taken but are not reported here. Calibration checks taken both at the gas chromotograph and through the monitoring pick-up points showed that the aromatics were being removed in the sample lines prior to instrument. This may have been due to the relatively cold ambient temperatures during the test. However, this lack of reliability in the test results made it impossible to use these data to evaluate the effectiveness of area monitors in detecting equipment leaks.

Table II-1: Summary of Results, VOC Concentration versus Occurrence Frequency;
All Units Sun Oil Company, Toledo, Ohio

EPA Data

VOC Concentration ppm hexane	EQUIPMENT TYPE												All Equipment	
	Pump Seals		Compressor Seals		Control Valves		Other Valves		Open-Ended Lines		Drains			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
0-200	39	62			73	75	1025	90	47	77	*		1184	87
201-1000	11	17			5	5	42	4	3	5			61	4
1001-10000	9	14			12	12	38	3	8	13			67	5
>10000	4	6			7	7	37	3	3	5			51	4
TOTAL	63		0		97		1142		61				1363	

* Drains at this facility are enclosed

Sun Oil Data

VOC Concentration ppm hexane	EQUIPMENT TYPE												All Equipment	
	Pump Seals		Compressor Seals		Control Valves		Other Valves		Open-Ended Lines		Drains			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
0-200	31	57			73	75	941	90	40	78			1085	87
201-1000	13	24			6	6	39	4	2	4			60	5
1001-10000	7	13			9	9	32	3	6	12			54	4
>10000	3	6			9	9	39	4	3	6			54	4
TOTAL	54		0		97		1051		51				1253	

Table II-2: Summary of Results, VOC Concentration versus Occurrence Frequency; Aromatics Recovery Unit; Sun Oil Company, Toledo, Ohio

EPA Data

VOC Concentration ppm hexane	EQUIPMENT TYPE												All Equipment	
	Pump Seals		Compressor Seals		Control Valves		Other Valves		Open-Ended Lines		Drains			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
0-200	24**	73			43	81	687	96	29	88	*		783	94
201-1000	5	15			4	8	11	1.5	2	6			22	3
1001-10000	3	9			4	8	9	1.3	2	6			18	2
>10000	1	3			2	4	8	1.1	0	0			11	1
TOTAL	33		0		53		715		33				834	

* Drains at this facility are enclosed

** Pump seals in benzene service have double mechanical seals

Sun Oil Data

VOC Concentration ppm hexane	EQUIPMENT TYPE												All Equipment	
	Pump Seals		Compressor Seals		Control Valves		Other Valves		Open-Ended Lines		Drains			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
0-200	24	73			44	83	635	98	20	91			723	94
201-1000	6	18			3	6	9	0.1	1	5			19	2
1001-10000	3	9			4	8	8	0.1	1	5			16	2
>10000	0	0			2	4	6	0.1	0	0			8	1
TOTAL	33		0		53		649		22				766	

Table II-3: Summary of Results: VOC Concentration versus Occurrence Frequency; Hydrodealkylation Unit, Sun Oil Company, Toledo, Ohio

DPA Data

VOC Concentration ppm hexane	EQUIPMENT TYPE												All Equipment	
	Pump Seals		Compressor Seals		Control Valves		Other Valves		Open-Ended Lines		Drains			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
0-200	15	50			30	68	338	79	18	64	*		401	76
201-1000	6	20			1	2	31	7	1	4			39	7
1001-10000	6	20			8	18	29	7	6	21			49	9
>10000	3	10			5	11	29	7	3	11			40	8
TOTAL	30		0		44		427		28				529	

* Drains at this facility were enclosed

VOC Concentration ppm hexane	EQUIPMENT TYPE												All Equipment	
	Pump Seals		Compressor Seals		Control Valves		Other Valves		Open-Ended Lines		Drains			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
0-200	7	33			29	66	306	78	20	69			362	74
201-1000	7	33			3	7	30	8	1	3			41	8
1001-10000	4	19			5	11	24	6	5	17			38	8
>10000	3	14			7	16	33	8	3	10			46	9
TOTAL	21		0		44		393		29				487	

TABLE II-4. SUMMARY OF RESULTS MEASUREMENT REPRODUCIBILITY BETWEEN TWO TEST TEAMS, SUN OIL CO., TOLEDO, OHIO

A = EPA Test Team

B = Sun Oil Test Team

VOC Concentration Range	Number of Cases With Results in the Same Range*	Number of Cases With Results NOT in Same Range*	% of Readings NOT in Same Range
0-100	1096	13	1%
101-1000	45	14	31%
1001-10000	53	18	34%
>10000	43	6	14%

Listing of Data Points With VOC >10000 That Had Different Result*

Team A Result	Team B Result
>10000	8000
>10000	5000
>10000	4000
>10000	4000
>10000	1000
>10000	3000

*EPA result used as reference.

TABLE II-5: WEIGHT PERCENT COMPARISON OF BENZENE CONTENTS: LIQUID SAMPLES AND ASSOCIATED VAPOR LEAKS

Source Type	LIQUID SAMPLE		VAPOR SAMPLE			Material Being Handled
	Sample Number	Wt. % Bz	Sample Number	Wt. % Bz	Bz ppmv	
Control Valve	404	23.654	403	1.270	5	Extractor Recycle
Pump	405	0.004	402	0.0	0	Benzene Tower Bottoms
Valve	431	0.826	407	1.583	6	Debutanizer Bottoms
Valve	432	0.962	408	0.902	7	Debutanizer Bottoms
Valve	433	0.022	409	0.0	0	Debutanizer Bottoms
Valve	434	0.578	410	0.0	0	Merox Product
Valve	435	1.045	411	0.0	0	Stabilizer Bottoms Heavy Reformate
Valve	414	5.987	412	9.670	524	Unit Feed
Waste Water Separator			416	0.0	0	Forebay
Waste Water Separator			415	7.661	14	Outfall
Waste Water Separator	425	0.399	421	1.235	21	Forebay
Waste Water Separator	426	0.555	422	2.855	2	Outfall
Pump	427	0.001	417	0.083	2	Reformate Tower Bottoms
Pump	428	2.519	418	2.632	131	Hydrocracked Gasoline
Motor Valve	429	0.003	419	0.0	0	Heavy Aromatics Xylene Tower Bottoms
Valve	430	0.0	420	0.308	1	BTX Raffinate

III. PROCESS DESCRIPTION

The Sun Petroleum Products Company, Toledo, Ohio, refinery is an integrated gasoline producing petroleum refinery. The units and equipment tested were those which had the potential for benzene emissions. Most of the testing was performed in the two units which process pure benzene, the BTX extraction unit and the toluene hydrodealkylation (HDA) unit. The BTX unit uses liquid-liquid tetraethylene glycol extraction to separate the aromatics from an aromatics reformer heartcut. The aromatics are then fractionated and the raffinate is sent to gasoline blending. The unit was about one year old when tested. During the design, construction and startup of the unit special care was taken to reduce equipment leaks. Process valves were repacked with two to three times the normal packing, double seals were used in benzene service, and all relief valves and process accumulator vessels were tied into the flare header system.

The HDA unit was originally built in 1961 as a naphthalene unit and was shut down in 1973. The unit was then modified and restarted as a 1 ton unit. Sun plans to make several changes to reduce leakage in the HDA unit (i.e., retrofit double seals), but these changes had not been made when the fugitive emissions testing was performed.

Based on discussions with plant personnel both process units were operating normally throughout the test period.

Both the BTX and HDA units had area monitoring systems manufactured by ARCAS. Company literature is shown in Appendix D. The BTX monitors measure ppm benzene, toluene and xylene sequentially through 15 points in the unit. The HDA monitor also measures through 15 sample points but for only benzene and toluene. Calibration testing of the BTX unit monitoring system showed this system was not operating properly during the test period so these data have not been analyzed in this report.

IV. SAMPLING AND ANALYTICAL PROCEDURES

The instrument used to conduct surveys at this facility was a Century Systems Corporation OVA-108 organic vapor analyzer. The instrument was calibrated daily at the test site. Methane in air standards were used.

Unit walkthrough surveys were performed by first identifying a proposed path so that the unit perimeter would be traversed, and all pumps and control valves at ground level would be surveyed within a distance of 1 meter. The instrument was then carried through the unit along this path with concentrations and location notations recorded on a strip chart recorder.

Individual component surveys were performed by traversing at the surface of the potential leak interface to determine local VOC concentrations. The highest observed concentration was recorded on a field data sheet.

The chromatographic techniques used to analyze the grab samples of vapors and liquids are described in Appendix A. Vapor samples were collected in 100 cc gas-tight glass syringes. Liquid samples were collected in 500 cc - 1000 cc glass or metal containers, as appropriate.

APPENDIX A

LABORATORY REPORT

MEASUREMENTS OF FUGITIVE VOC EMISSIONS FROM A PETROLEUM REFINERY IN TOLEDO, OHIO

Contract 68-02-2815
Work Assignment 27

Submitted to

U.S. Environmental Protection Agency
Emission Measurement Branch
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

Submitted by

Engineering-Science
7903 Westpark Drive
McLean, VA 22102

April 1979

TABLE OF CONTENTS

		Page
SECTION I	INTRODUCTION	I-1
SECTION II	RESULTS	II-1
SECTION III	ANALYTICAL PROCEDURES	III-1
	FIELD TESTING	III-1
	LABORATORY ANALYSIS OF LIQUID AND HEAD SPACE SAMPLES	III-3
APPENDIX A	FIELD DATA STANDARDS AND SAMPLE ANALYSES	
APPENDIX B	LABORATORY DATA SHEETS FOR LIQUID AND HEADSPACE ANALYSES	

LIST OF TABLES

TABLE II-1	TOLEDO - FIELD SAMPLES	II-3
TABLE II-2	EPA - SUN OIL - LIQUID SAMPLES	II-6
TABLE II-3	HEAD SPACE - WASTEWATER SAMPLES	II-8

SECTION I
INTRODUCTION

The United States Environmental Protection Agency, Office of Air Quality Planning and Standards (OAQPS) is currently investigating the magnitude and nature of fugitive volatile organic carbon (VOC) emissions from petroleum refineries for the purpose of recommending appropriate emission standards for that industry. Engineering-Science was issued Task Order Number 24 under Contract Number 68-02-2815 to provide field testing capabilities for development of fugitive emission data from a petroleum refinery.

The field test program was conducted at the Sun Oil Company's Toledo Ohio facility during the period from November 13 through November 17, 1978. The test program utilized two portable total hydrocarbon analyzers (Century Organic Vapor Analyzer, OVA) and a Hewlett Packard 5830A gas chromatograph (gc) equipped with dual flame ionization detectors. This report presents only test results obtained with the gc.

The remainder of this report is divided into two sections as follows:

Section II - Summary of Results

Section III - Analytical Procedures

In addition, raw field data, example calculations, and laboratory data are presented as appendices.

SECTION II
RESULTS

The result of the syringe samples collected and analyzed during the field test program are presented in Table II-1. Chromatograms were subdivided into carbon number by retention times. The gc response for compounds of special interest (aromatics) were extracted from the subdivisions and calculated independently from those groups. The electronic response for each group (C_1, C_2 . . . C_{10} parafins, aromatics, and known olefins) was subtotaled and an average response factor for each group applied to obtain a corrected instrument response. These values were totaled to obtain total hydrocarbon count. The weight percent per group was then determined and is presented in Table II-1 for field samples and Tables II-2 and II-3 for liquid and head space samples, respectively. In addition, for the field samples, a total hydrocarbon concentration was determined by applying the averge instrument response as determined from the propane standard to the total corrected instrument response for the sample. The table also presents the percent total reactive hydrocarbons which was determined by subtracting the C_1 and C_2 weight percents from 100%. This value assumes that all C_2 found was ethane since ethane and ethylene resolution was not possible with the analytical conditions used.

Table II-2 presents the results of the liquid sample analyses performed in the ES McLean Laboratory. The weight percent values were determined in the same manner used to calculate weight percent for the gaseous field samples. Total ppm was calculated by comparing the total corrected instrument response for the sample to an average total instrument response for retention time mixtures. The mixtures were pure hydrocarbon and, therefore, given a value of 1,000,000 ppm. Since this value is based on a single calibration point (10^6 ppm), it provides only an approximate estimate of the hydrocarbon content of the samples.

Head space from the two wastewater samples (425 and 426) were also analyzed by gc. The results of these analyses are presented in Table II-3. No total ppm value was determined since this value was not considered relevant to any real conditions.

Due to the complexity of the sample compositions for both field and laboratory analyses, it was not possible to distinguish between olefins and parafins. Only a few straight chain olefins were identified. These are reported in the summary tables.

TABLE II-1

TOLEDO - FIELD SAMPLES

VOC ANALYTICAL SUMMARY

SAMPLE NUMBERS	401[1]	402[1]	403[1]	406[1]	407	408	409	410
PARAFINS	WEIGHT PERCENT							
C_1	49.423			66.083				
C_2	14.177		2.378					
C_3					4.739	0.548	0.116	
C_4				11.461	1.186	1.275	35.428	18.101
C_5	2.032	24.840	2.226	14.461	1.803	5.765	10.989	51.639
C_6			24.413	7.995	6.458	15.866		6.581
C_7	7.292		3.662		11.009	17.231		7.244
C_8	14.630	3.357			14.349	5.784		8.113
C_9		21.470			8.123	2.567		1.876
C_{10}	3.709				6.434	11.465		
AROMATICS								
BENZENE	8.737		1.270		1.583	0.902		
TOLUENE		28.441			11.150	3.828		2.724
XYLENES		21.320	64.707		25.649	10.537		2.497
ETHYL BENZENE		0.153						
MESITYLENE		0.420			7.519	7.702		1.227
OLEFINS								
C_2								
C_3								
C_4			1.345			0.767	53.423	
C_5						11.224	0.046	
C_6						4.539		
TOTAL ppm [2]	2,139	32,864	2,482	277	2,098	4796	20,416	1049
TOTAL REACTIVE HYDROCARBONS,%	36.4	100	97.622	33.917	100	100.000	100	100

[1]Values obtained from a single analysis of the sample

[2]PPM as Methane, determined from propane standard

TABLE II-1 (Cont.)

TOLEDO FIELD SAMPLES

VOC ANALYTICAL SUMMARY

SAMPLE NUMBERS	411	412	413	415	416	417	418	419[1]
PARAFINS	WEIGHT PERCENT							
C_1		0.118		0.145	4.632	0.007	0.016	
C_2		0.031		0.151				
C_3				1.830			0.268	
C_4				4.217	13.857		2.735	
C_5		1.981		3.549	41.937		38.660	
C_6		15.305		2.963	20.451	0.012	27.517	
C_7	1.122	10.678		4.217	2.377	4.279	16.276	
C_8	4.604	2.507		8.040	5.437	0.061	3.704	
C_9	2.407	0.723		4.504		0.012	1.370	
C_{10}	26.411	1.914		14.061		52.014	2.517	43.681
AROMATICS								
BENZENE		9.670	100	7.661		0.083	2.632	
TOLUENE	7.927	29.231		17.410	7.047		3.037	
XYLENES	34.478	25.606		22.575	4.264	28.418	0.704	1.689
ETHYL BENZENE	1.563							
MESITYLENE	21.490	2.236		8.681		15.116	0.568	54.630
OLEFINS								
C_2								
C_3								
C_4								
C_5								
C_6								
TOTAL ppm[2]	1,670	32,492	113	1,078	473	15,249	29,977	1,296
TOTAL REACTIVE HYDROCARBONS,%	100	100.000	100	99.704	95.368	99.993	99.984	100

0013

[1] Values obtained from a single analysis of the sample.

[2] ppm as methane, determined from propane standard.

TOLEDO FIELD SAMPLES

VOC ANALYTICAL SUMMARY

SAMPLE NUMBERS	420[1]	421[1]	422[1]	423	424[1]			
PARAFINS	WEIGHT PERCENT							
C_1								
C_2		0.025						
C_3		1.072	0.706					
C_4		28.156	6.743					
C_5	4.076	28.215	14.196					
C_6	20.558	14.654	10.080					
C_7	20.905	13.326	12.953					
C_8	20.146	3.774	4.531					
C_9	4.084	1.049	2.975		0.402			
C_{10}	12.236	1.079	6.806	0.190	0.585			
AROMATICS								
BENZENE	0.308	1.235	2.855	3.817	4.492			
TOLUENE	2.675	4.485	13.550	45.650	47.163			
XYLENES	9.736	1.889	15.980	47.685	46.650			
ETHYL BENZENE		0.233	2.599					
MESITYLENE	5.278	0.809	6.027		0.442			
OLEFINS								
C_2								
C_3								
C_4								
C_5				2.660	0.266			
C_6								
TOTAL ppm[2]	2,013	10,350	314	807	778			
TOTAL REACTIVE HYDROCARBONS,%	100	99.975	100	100	100			

0013

[1] Values obtained from a single analysis of the sample.

[2] ppm as methane, determined from propane standard.

VOC ANALYTICAL SUMMARY TOLEDO FIELD SAMPLES

VOC CONCENTRATIONS

SAMPLE NUMBERS	401	402	403	406	407	408	409	410
PARAFINS	ppm HC							
C_1	1057			183				
C_2	152		30					
C_3					33	9	8	
C_4				8	7	15	.1808	47
C_5	9	1633	11	8	7	55	449	108
C_6			101	4	22	127		12
C_7	22		13		33	118		11
C_8	39	138			38	35		11
C_9		784			19	14		2
C_{10}	8				14	55		
AROMATICS								
BENZENE	31		5		6	7		
TOLUENE		1335			33	26		4
XYLENES		876	201		67	63		3
ETHYL BENZENE		6						
MESITYLENE		15			17	41		1
OLEFINS								
C_2								
C_3								
C_4			8			9	2727	
C_5						108	2	
C_6						36		
TOTAL ppm v*	2138	32864	2482	277	2097	4794	20416	1048
TOTAL REACTIVE HYDROCARBONS								

E003

* Total ppmv as methane.

VOC ANALYTICAL SUMMARY TOLEDO FIELD SAMPLES

VOC CONCENTRATIONS

SAMPLE NUMBERS	411	412	413	415	416	417	418	419
PARAFINS	ppm HC							
C_1		38		2	26	1	4	
C_2		5		1				
C_3				7			26	
C_4				12	16		202	
C_5		129		8	38		2307	
C_6		829		6	17	(0.3)	1368	
C_7	3	496		7	1	108	709	
C_8	10	102		11	4	1	138	
C_9	4	26		5		(0.1)	46	
C_{10}	45	62		15		771	77	57
AROMATICS								
BENZENE		524	19	14		2	131	
TOLUENE	19	1357		26	5		130	
XYLENES	71	1040		30	3	527	27	3
ETHYL BENZENE	3							
MESITYLENE	40	81		10		282	20	79
OLEFINS								
C_2								
C_3								
C_4								
C_5								
C_6								
TOTAL ppmv*	1672	32491	113	1080	473	15248	29976	1296
TOTAL REACTIVE HYDROCARBONS								

0013

* Total ppmv as methane.

VOC ANALYTICAL SUMMARY TOLEDO FIELD SAMPLES

VOC CONCENTRATIONS

SAMPLE NUMBERS	420	421	422	423	424			
PARAFINS	ppm HC							
C_1								
C_2		2						
C_3		37	(0.7)					
C_4		729	5					
C_5	16	584	9		(0.4)			
C_6	69	253	5					
C_7	60	197	6					
C_8	51	49	2					
C_9	9	12	1					
C_{10}	25	11	2	(0.2)	(0.5)			
AROMATICS								
BENZENE	1	21	2	5	6			
TOLUENE	8	66	6	53	52			
XYLENES	25	24	6	48	45			
ETHYL BENZENE		3	1					
MESITYLENE	12	9	2		(0.3)			
OLEFINS								
C_2								
C_3								
C_4								
C_5				4				
C_6								
TOTAL ppm v*	2013	10351	314	808	778			
TOTAL REACTIVE HYDROCARBONS								

* Total ppmv as methane.

TABLE II-2

EPA - SUN OIL LIQUID SAMPLES

VOC ANALYTICAL SUMMARY

SAMPLE NUMBERS	404	405	414	425	426	427	428	429
PARAFINS	WEIGHT PERCENT							
C_1	0.000		0.000	0.000		0.000	0.000	0.000
C_2								
C_3				0.002			0.119	
C_4	0.000		0.000	0.404			2.279	0.000
C_5	0.894		0.716	1.309	1.911	0.244	42.963	0.001
C_6	8.191	0.004	5.786	2.832	4.978	0.002	25.333	0.005
C_7	9.636	0.003	10.496	8.654	7.663	0.002	19.166	0.003
C_8	1.710		3.755	6.225	2.262	0.001	4.679	0.003
C_9	3.040	1.468	1.512	2.591	31.020	0.002	0.148	0.032
C_{10}	6.598	4.141	16.831	65.433	50.778	84.354	0.224	99.803
AROMATICS								
BENZENE	23.654	0.004	5.987	0.399	0.555	0.001	2.519	0.003
TOLUENE	31.976	42.075	26.837	5.160	0.832	0.005	2.461	0.010
XYLENES	14.300	41.855	22.781	4.731		7.966	0.108	0.141
ETHYL BENZENE		10.450	5.299	2.260		7.422		
MESITYLENE								
OLEFINS								
C_2			0.000				0.000	
C_3								
C_4								
C_5								
C_6								
TOTAL ppm	1000000	1000000	1000000	650000	4200	1000000	590000	960000
TOTAL REACTIVE HYDROCARBONS	100	100	100	100	100	100	100	100

0013

TABLE II-2 (Cont.)

EPA - SUN OIL LIQUID SAMPLES

VOC ANALYTICAL SUMMARY

SAMPLE NUMBERS	430	431	432	433	434	435		
PARAFINS	WEIGHT PERCENT							
C_1								
C_2								
C_3								
C_4	0.000							
C_5	0.727							
C_6	19.161							
C_7	25.465							
C_8	10.604							
C_9	3.214							
C_{10}	30.889							
AROMATICS								
BENZENE		0.826	0.962	0.022	0.578	1.045		
TOLUENE	0.610	3.824	4.061	0.006	1.356	5.751		
XYLENES	4.963	8.156	7.646	0.004	0.647	15.861		
ETHYL BENZENE	4.366	3.089	2.939		0.229	4.510		
MESITYLENE								
OLEFINS								
C_2								
C_3								
C_4		0.006	0.029	0.186				
C_5		0.064	0.101	1.535				
C_6								
TOTAL ppm	1000000	880000	1000000	306000	150000	885000		
TOTAL REACTIVE HYDROCARBONS	100	100	100	100	99.999	100		

TABLE II-3

HEAD SPACE - WASTEWATER SAMPLES

VOC ANALYTICAL SUMMARY

SAMPLE NUMBERS			425	426				
PARAFINS	WEIGHT PERCENT							
C_1			0.372	0.567				
C_2			0.122	0.161				
C_3			2.223	1.094				
C_4			33.521	4.722				
C_5			21.423	3.515				
C_6			8.557	1.157				
C_7			11.227	3.038				
C_8			4.130	1.311				
C_9			1.031	0.667				
C_{10}			5.169	73.955				
AROMATICS								
BENZENE			0.756	0.038				
TOLUENE			3.389	2.175				
XYLENES			1.556	6.450				
ETHYL BENZENE			0.175					
MESITYLENE								
OLEFINS								
C_2								
C_3								
C_4								
C_5								
C_6			6.348	1.153				
TOTAL ppm								
TOTAL REACTIVE HYDROCARBONS			99.505	99.275				

0013

SECTION III
ANALYTICAL PROCEDURES

FIELD TESTING

ES employed a Hewlett Packard 5830A dual FID gas chromatograph for determination of the composition of grab samples provided by the EPA test team. Samples were collected in glass 100 cubic centimeter syringes. The gc was equipped with a gas sampling valve and 1 cc sample loops. The valve inlet was sealed with a septum. Samples were injected from the glass syringes through the septum and flushed through the gas sample loops. A minimum of 20 cc of sample was used to flush the valve prior to each sample injection. After duplicate analysis of a single sample or standard, the gas sampling valve was flushed for several minutes with zero grade air (total hydrocarbon less than 1 ppm) prior to injection of the next sample. All samples were analyzed on the same day as their collection. Between the time of collection and sample analysis, samples were stored in an opaque container to protect against component degradation.

The column used for the analysis was a 6 foot by 1/8 inch (outside diameter) stainless steel column packed with 5% SP 1200/1.75% Bentone 34 on 100/120 mesh Supelcoport. The column was operated at 58°C for 15 minutes and temperature programmed to increase oven heat at a rate of 5°C per minute to a maximum temperature of 160°C. Compounds of primary interest were aromatic hydrocarbons. Prior to conductance of the field test, ES established retention times for approximately 30 compounds including benzene, toluene, xylenes, ethylbenzene, straight chain and branched paraffins through C_9 and straight chain olefins through C_6. These retention times were established under isothermal conditions at 58°C. Due to the rather lengthy time required to perform a single isothermal analysis in the field (approximately 100 minutes), it was decided to utilize temperature programming. A mixture of eleven compounds was used to re-establish retention times in the field.

Instrument calibration was performed using propane and benzene standards. The propane standards were 93.7, 987, and 100,000 parts per million in air. At least one propane standard was run daily. Area counts as determined by the electronic integrator were divided by the propane concentrations to obtain a counts per ppm of propane value. Over the four day period and the 100,000 ppm standard range, the counts per ppm averaged 271.94 with a range of 254.4 - 287.7 and a standard deviation of 13.79. The maximum error was determined to be $\pm$ 9.76%. Propane standard data is presented in Appendix A.

Benzene standards were nonlinear during the first three days of field testing. On the final day a linear response was obtained. The reason for the nonlinearity was not successfully determined. The most probable explanations for the nonlinearity are as follows:

1. Column leakage
2. Improper carrier/hydrogen/air mix
3. Condensation in sample valve system

All of these operating problems could have a similar affect on the sample analysis as on the standard analysis. A leak in the carrier gas system would also be expected to have an effect on the propane standard, which case was not observed. The propane standard was linear in the range from 93.7 to 100,000 ppm.

Nonlinearity of the propane standard would also be expected if the air/fuel/carrier mix was incorrect. Although it would probably be less severe than the nonlinearity observed in the benzene standard, it is expected that nonlinearity would be apparent when considering the range (93.7 - 100,000 ppmv) of propane standards run during the test period as compared to the benzene standards (4.77 - 999 ppm).

The third possible explanation for the nonlinear benzene curve is condensation of benzene in the sample injection system. The gas sampling valve and associated tubing used was not heated since samples were collected at ambient temperature. When high concentrations of benzene and other heavy compounds were injected, it is possible for some condensation to occur. However, the standard gas mixtures were relatively low concentrations and all of

the internal valve parts were stainless steel. Thus it is difficult to assume condensation as the sole explanation for nonlinearity. In all probability some combination of the three factors mentioned may have resulted in the nonlinear benzene response.

LABORATORY ANALYSIS OF LIQUID AND HEAD SPACE SAMPLES

Process stream and wastewater samples were collected during the field test program and returned to the ES McLean Laboratory for analysis. Prior to analysis the gc was checked for linear response using a series of liquid dilutions of C_{14}, C_{15}, and C_{16} hydrocarbons. In the interim from the field test program to the laboratory analysis, two modifications were made to the system. First, the gas sampling valves were removed from the system to allow on-column injection. Second, the carrier gas was changed from helium to nitrogen since nitrogen is reported by the manufacturer to have a broader linear range than helium. The resulting linearity check showed good linear response over the range from 20 to 20,000 ppm.

Liquid samples collected in the field were transported in ice to the ES laboratory in McLean, Virginia. Samples were then refrigerated until analysis was performed. Due to instrument linearity checks, liquid sample analyses were not completed until February 16, 1979. Although samples were sealed, protected from light, and refrigerated during the three month interim from the time of collection, some sample degradation may have occurred.

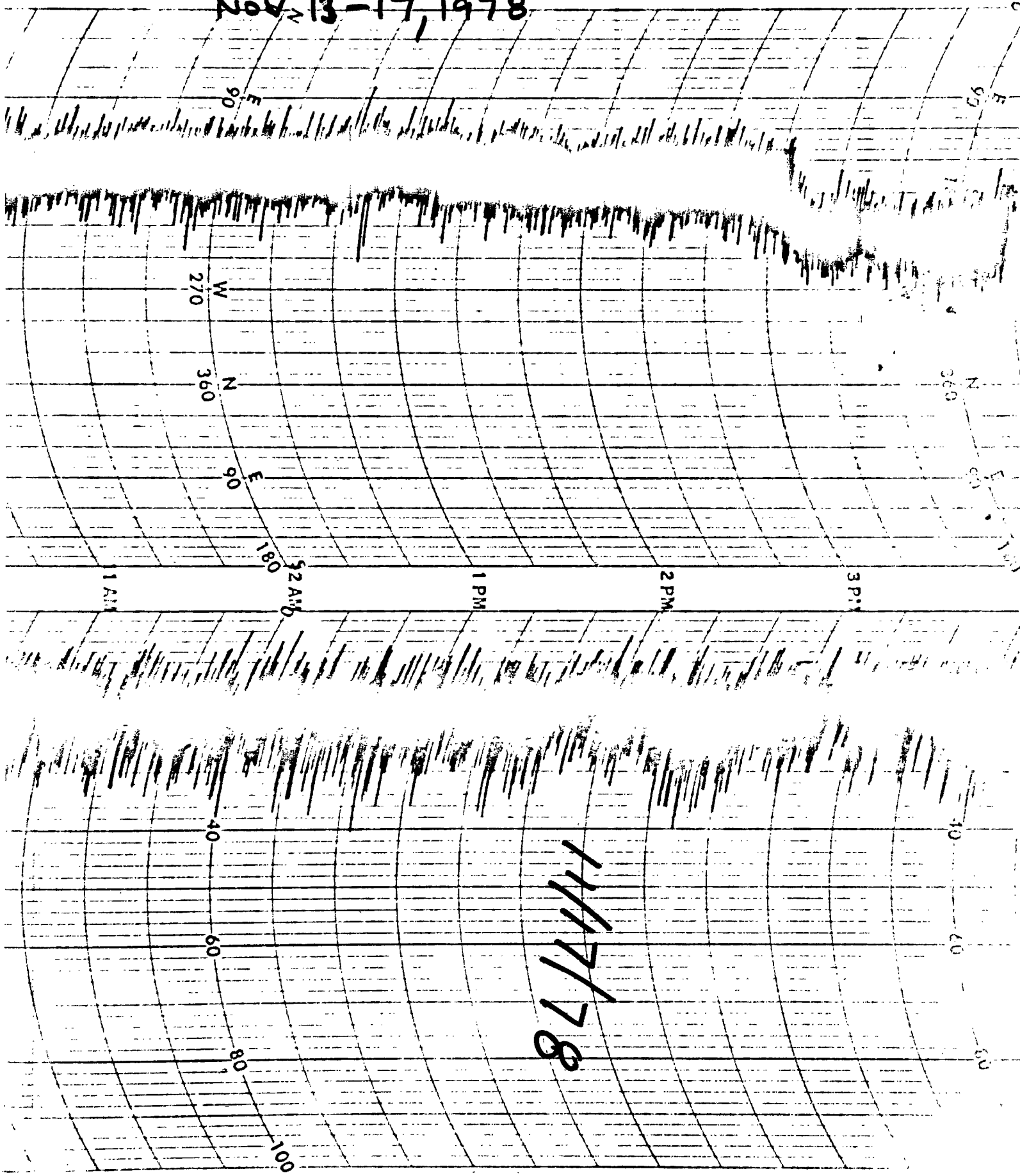
Prior to analysis, portions of the samples were gravity filtered through Whatman Number 1 filter paper to remove particulate material. One microliter aliquot was injected into a 200°C injection port. The column used for liquid analysis was 10 foot by 1/8" stainless steel packed with 20% SP2100/0.1% Carbowax 1500 on 100/120 mesh Supelcoport. The oven was maintained at 35°C for 15 minutes then temperature programmed at a rate of 5°C per minute to a maximum temperature of 165°C. All liquid samples were run in duplicate. One cc headspace injection was made from the wastewater samples (Numbers 425 and 426).

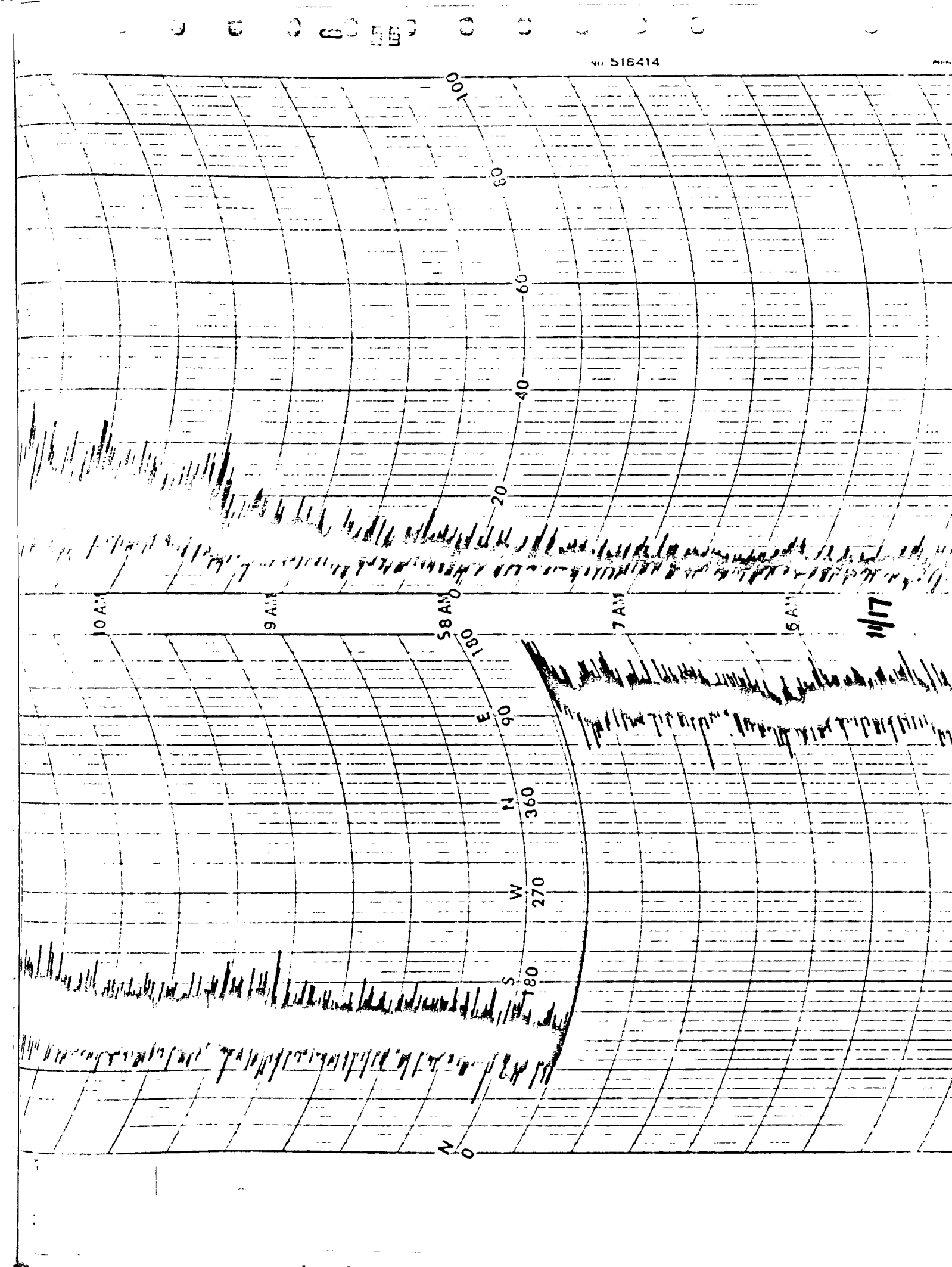
Example calculations are presented in Appendix C. Field and laboratory raw data is presented in Appendix A and B, respectively.

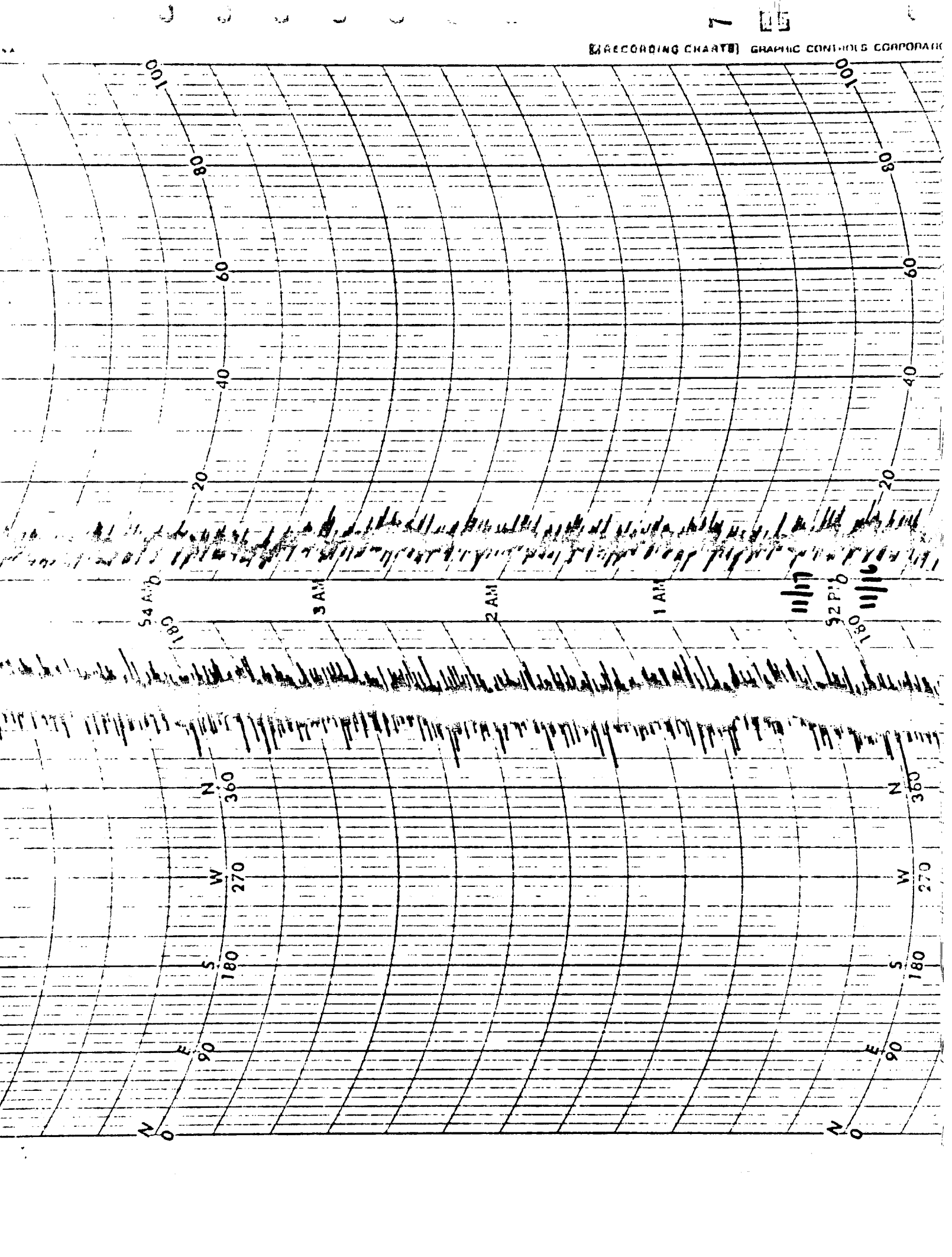
APPENDIX B

FIELD DATA SHEETS

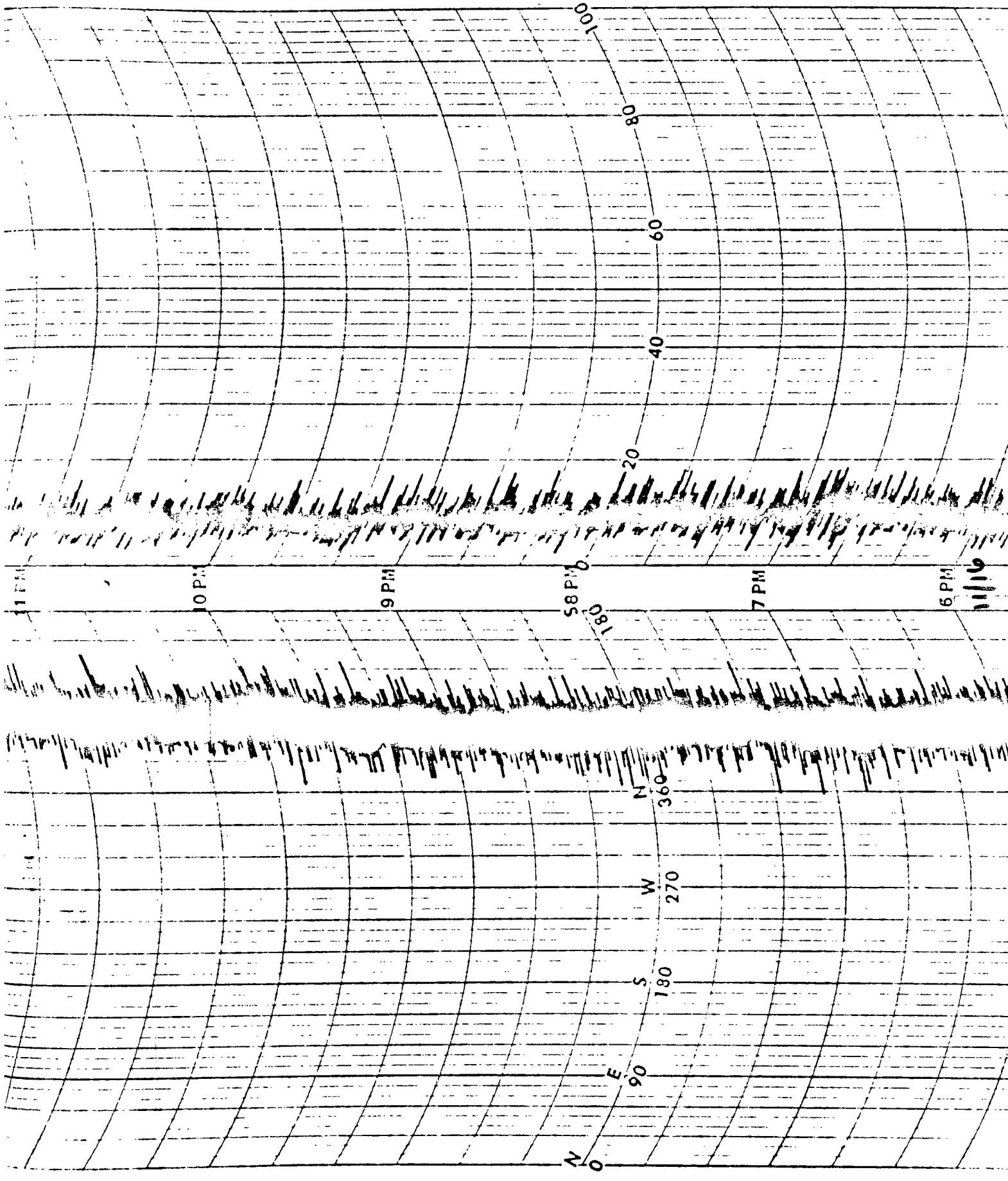
SUNOIL TOLEDO, OHIO
WIND SPEED & DIRECTION
NOV 13-17, 1978

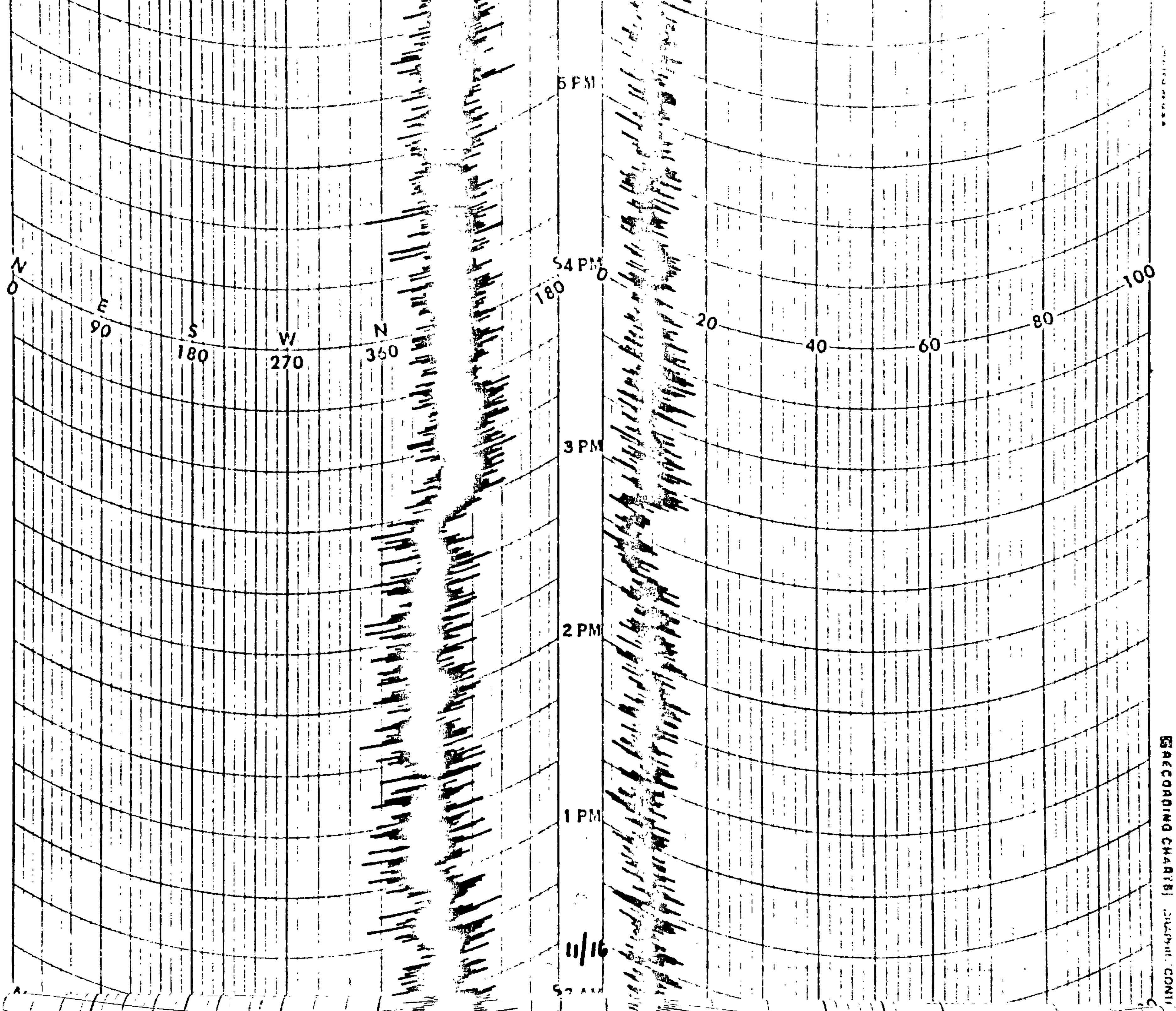


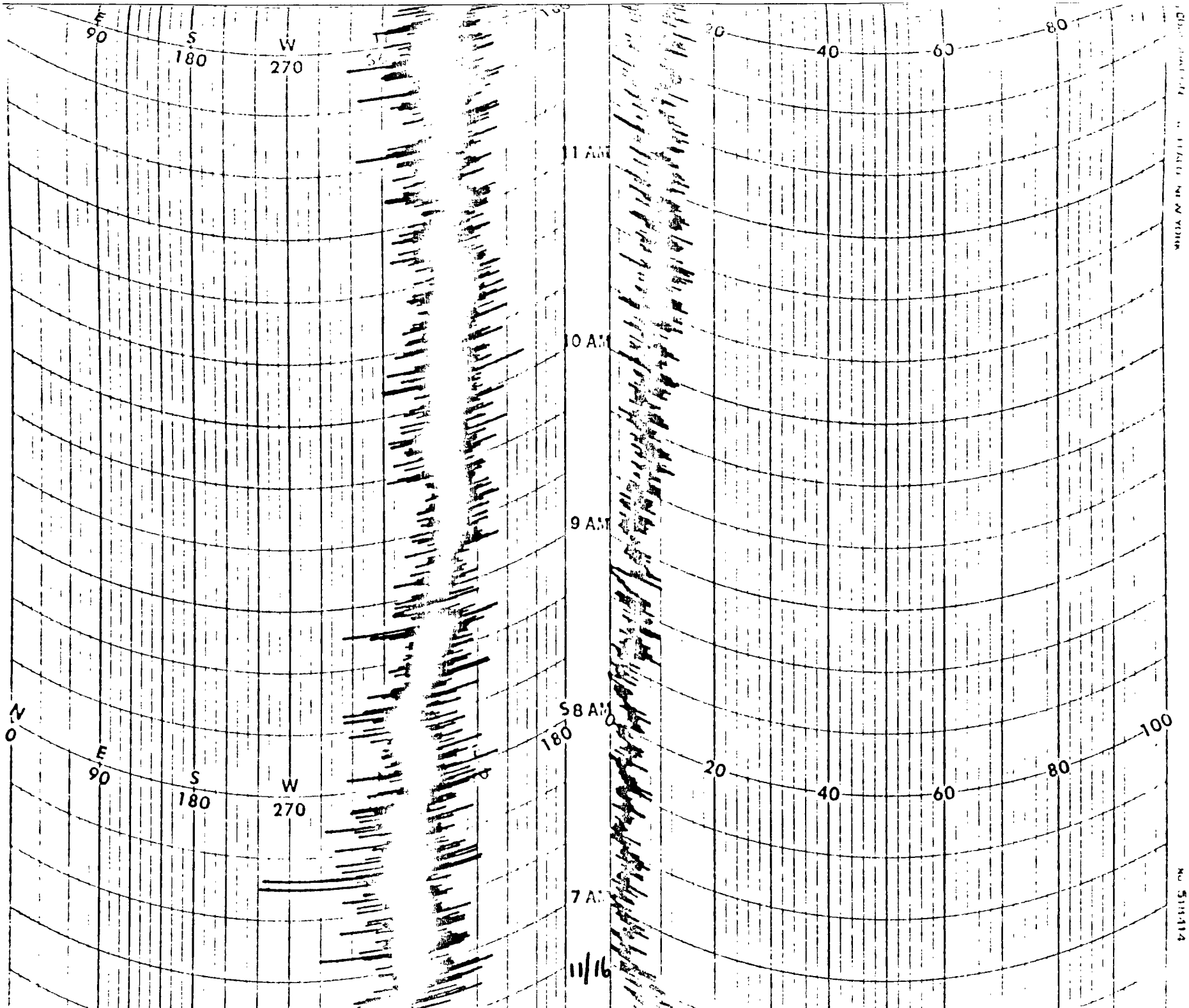

100
60
40
20
0
10 AM
9 AM
8 AM
7 AM
6 AM
180
E
90
N
360
W
270
S
180
N
0

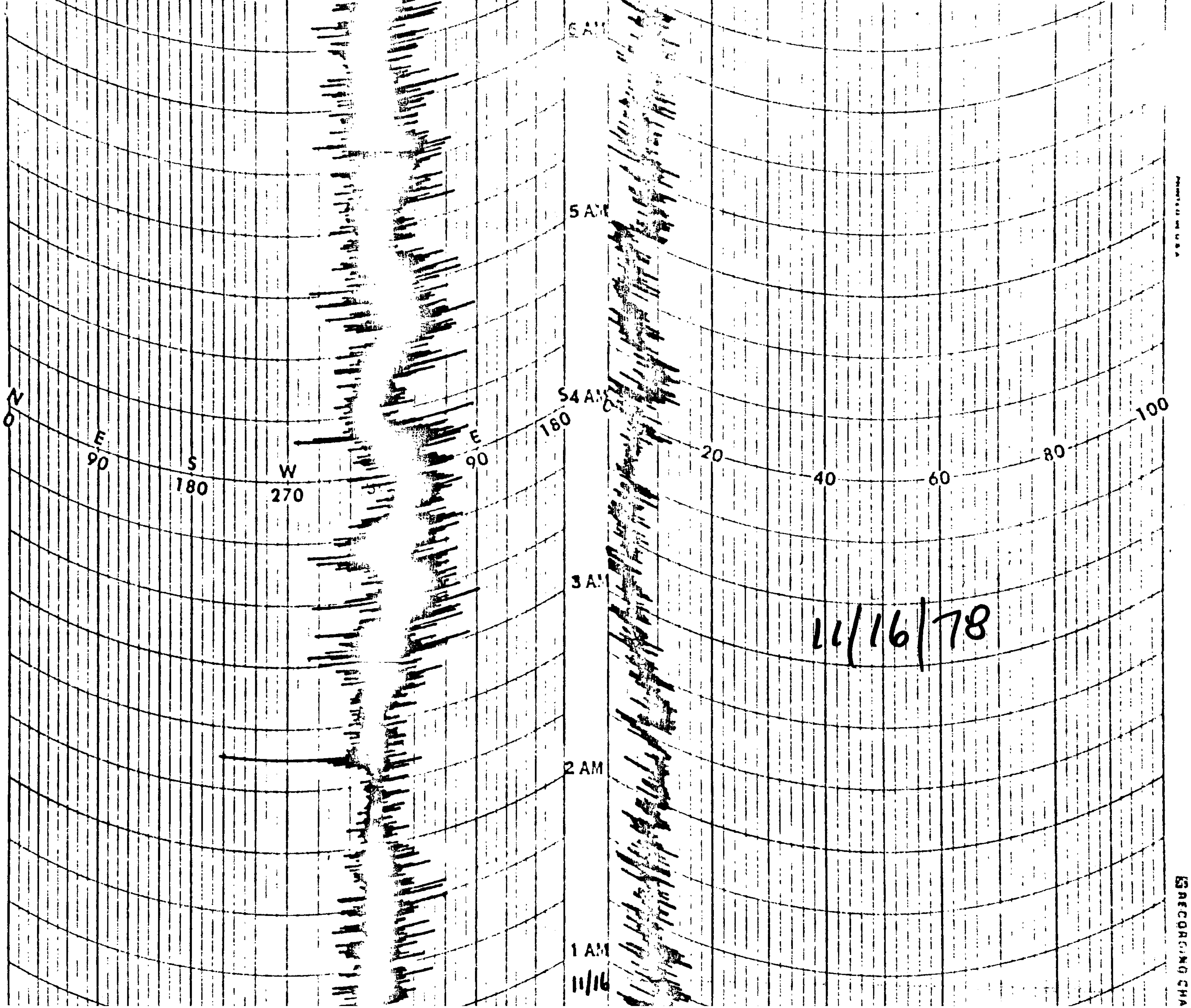

RECORDING CHARTS GRAPHIC CONTROLS CORPORATION
100
80
60
40
20
0
3 AM
2 AM
1 AM
N
W
S
E
360
270
180
90

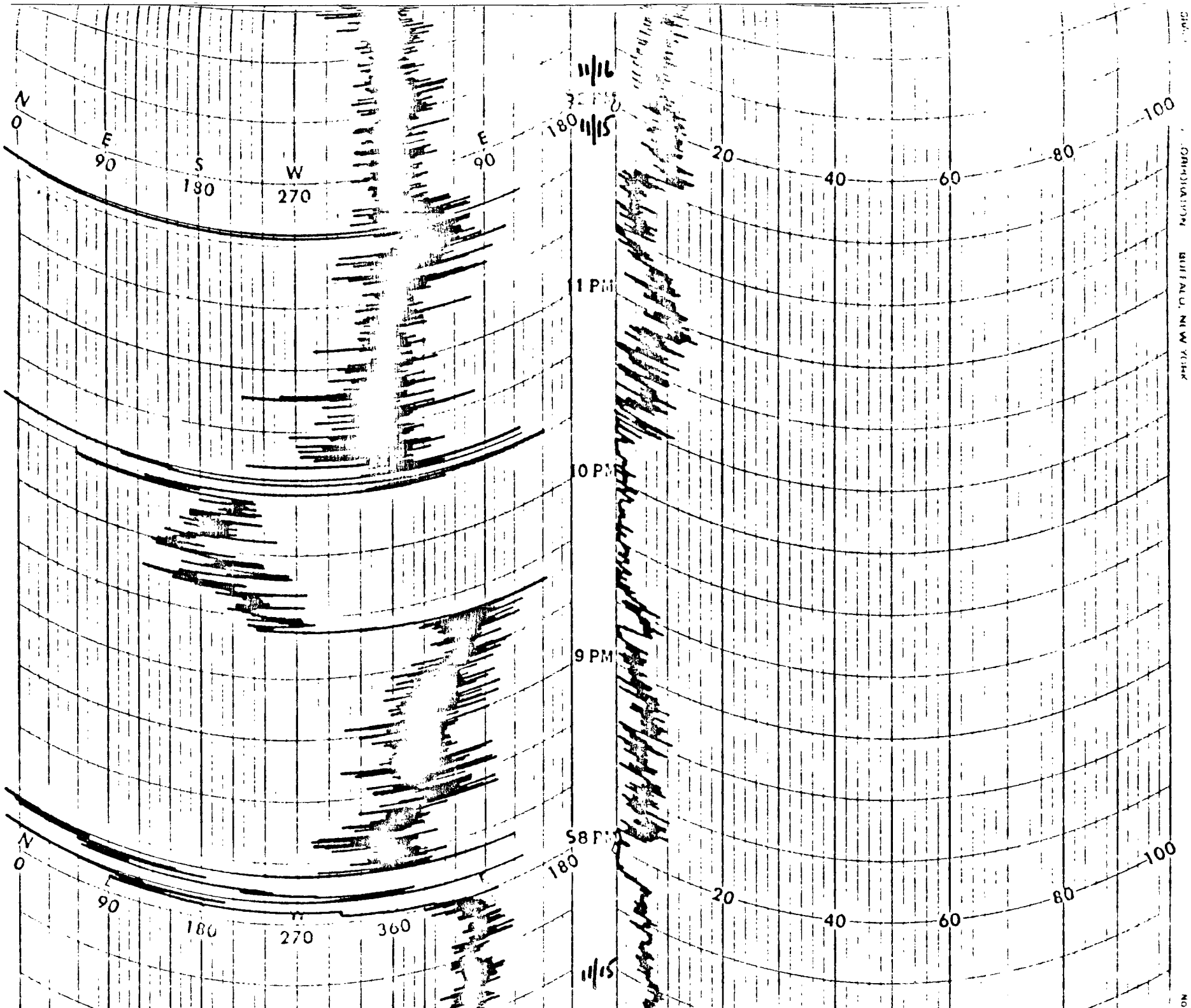
No. 518414

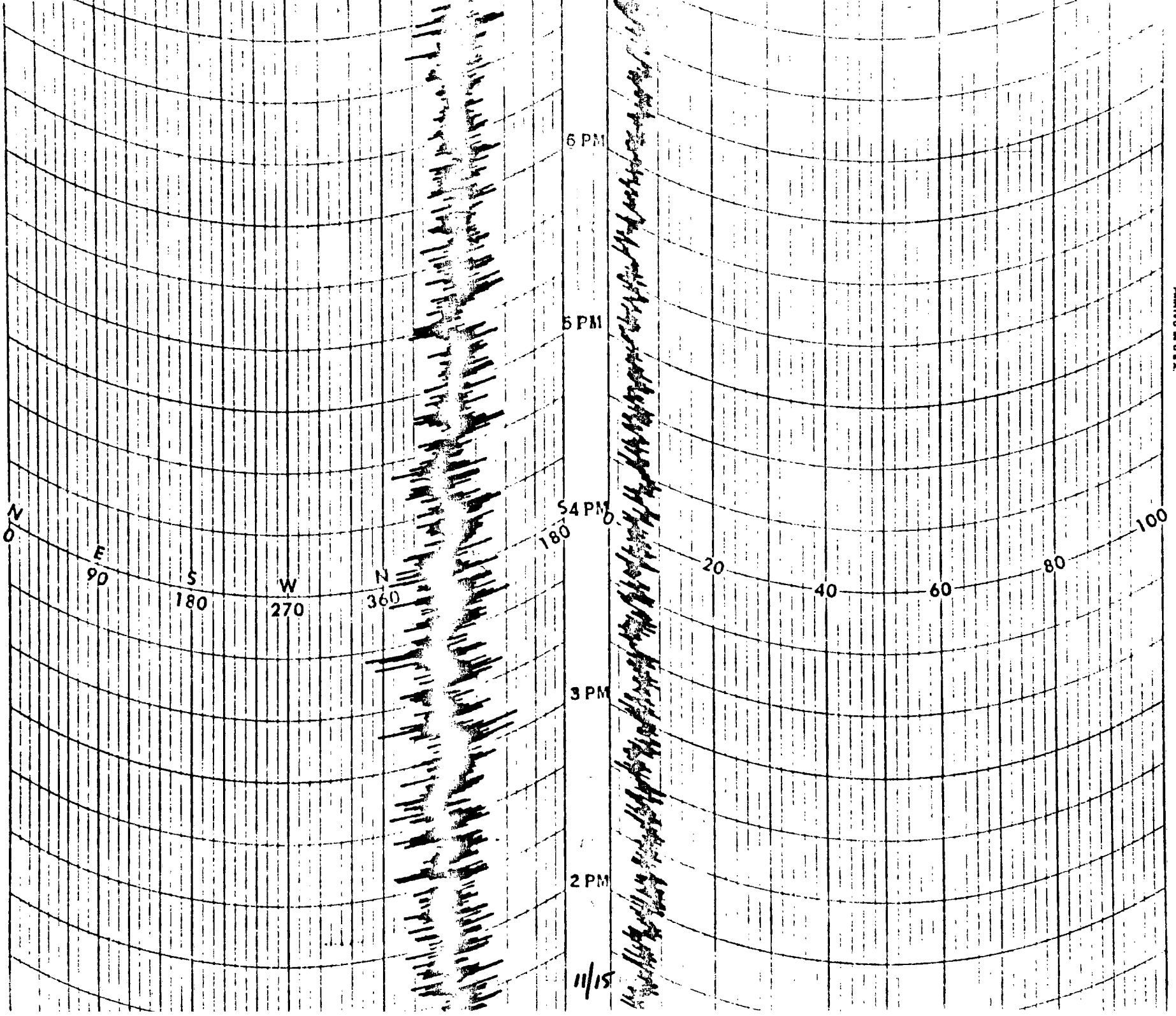


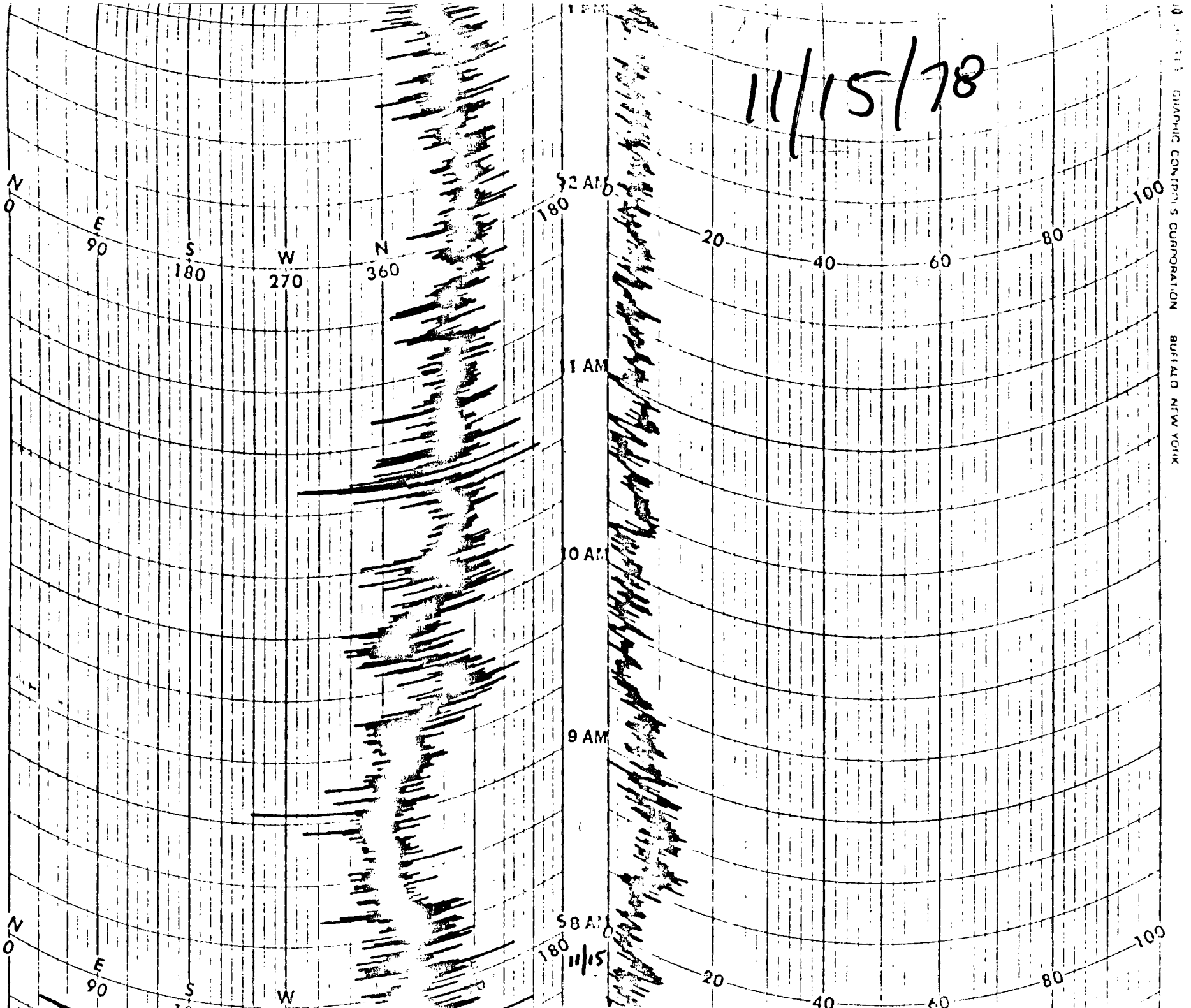

N
0
E
90
S
180
W
270
N
360
180
0
20
40
60
80
100
5 PM
4 PM
3 PM
2 PM
1 PM
11/16
RECORDING CHARTS

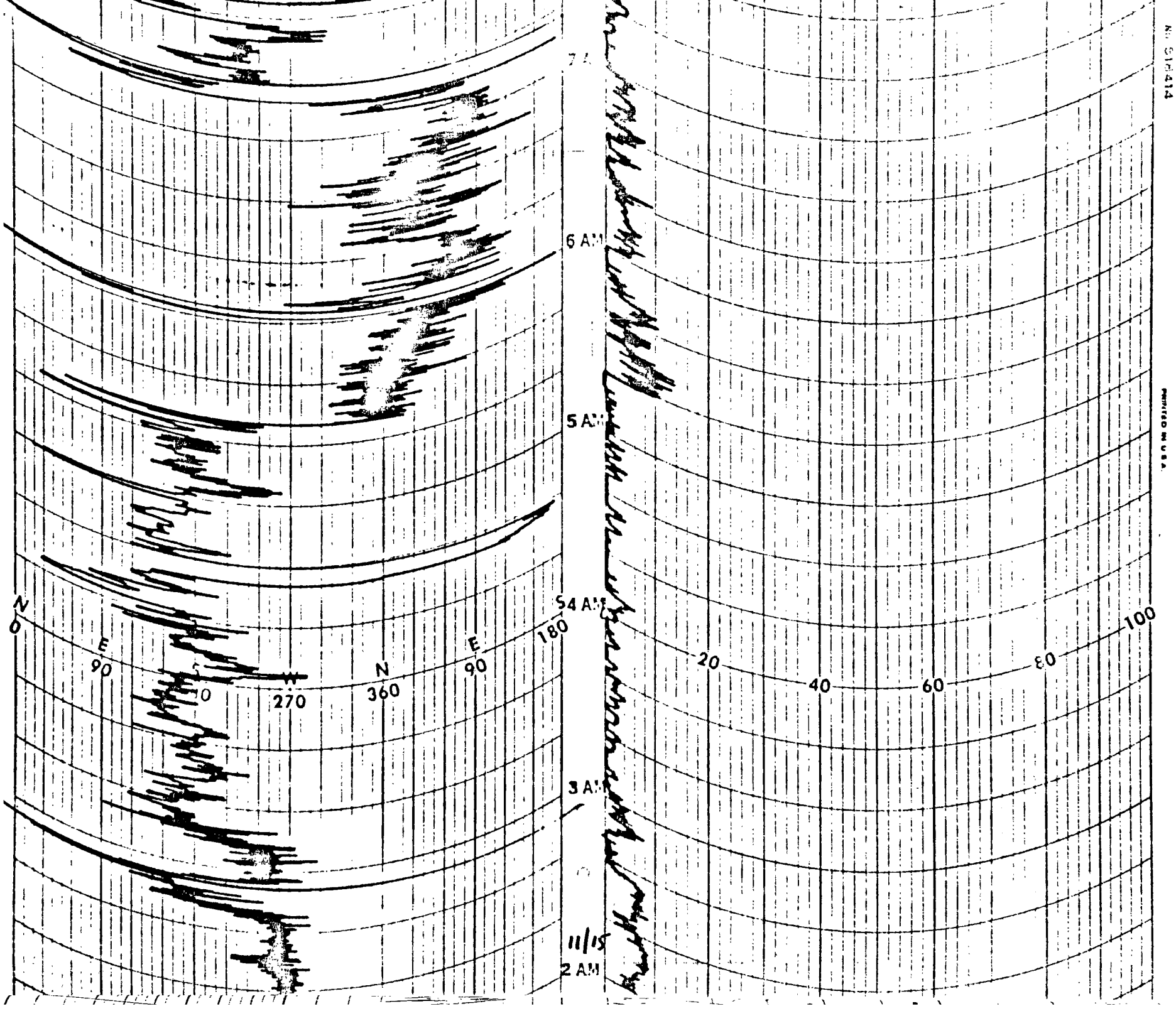

N
0
E
90
S
180
W
270
20
40
60
80
100
11 AM
10 AM
9 AM
8 AM
7 AM
11/16


6 AM
5 AM
4 AM
3 AM
2 AM
1 AM
11/16
N
0
E
90
S
180
W
270
E
90
S
180
0
20
40
60
80
100
11/16/78

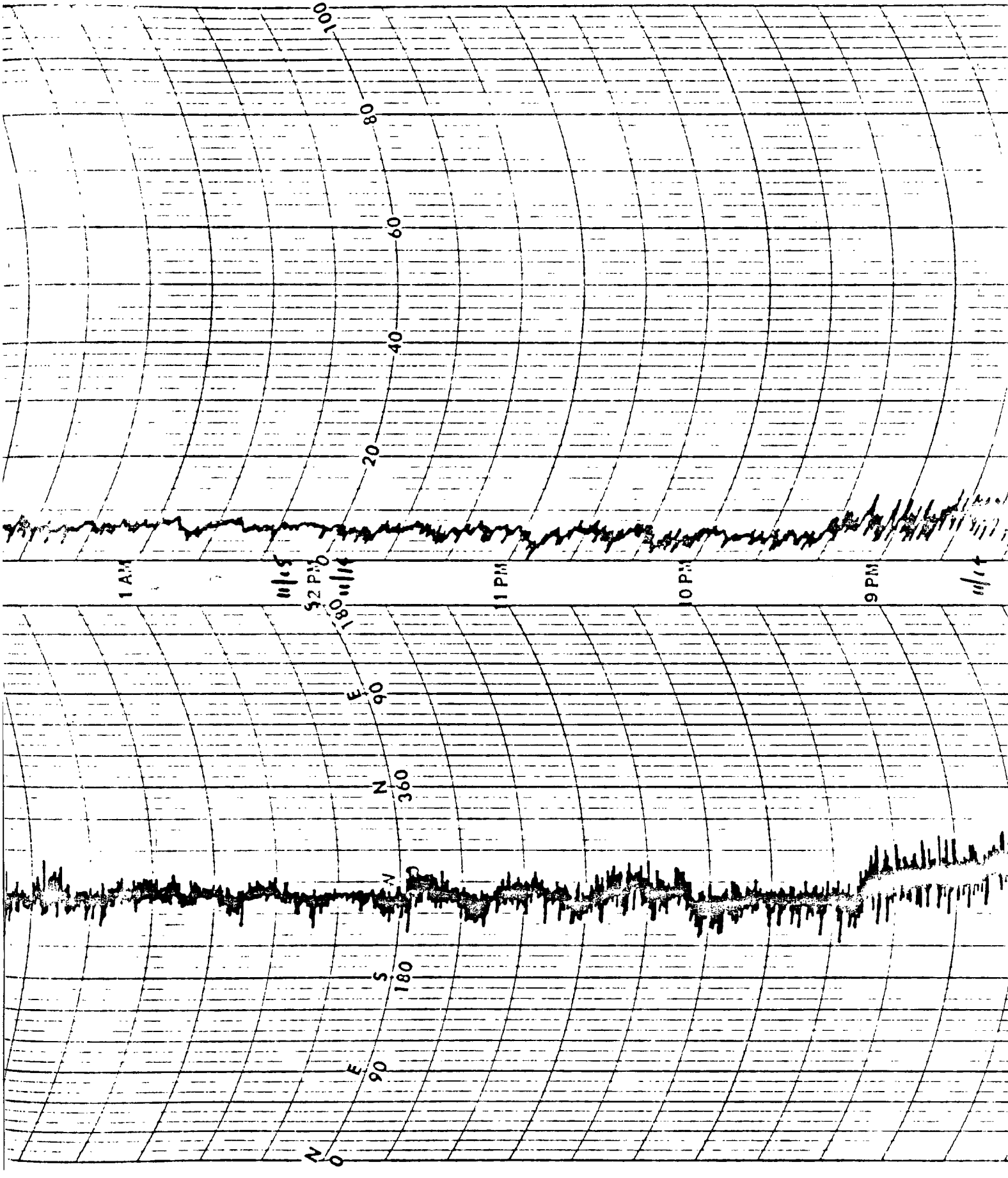

N
0
E
90
S
180
W
270
E
90
11/16
180
11/15
20
40
60
80
100
1 PM
10 PM
9 PM
8 PM
N
0
90
180
270
360
180
11/15
20
40
60
80
100

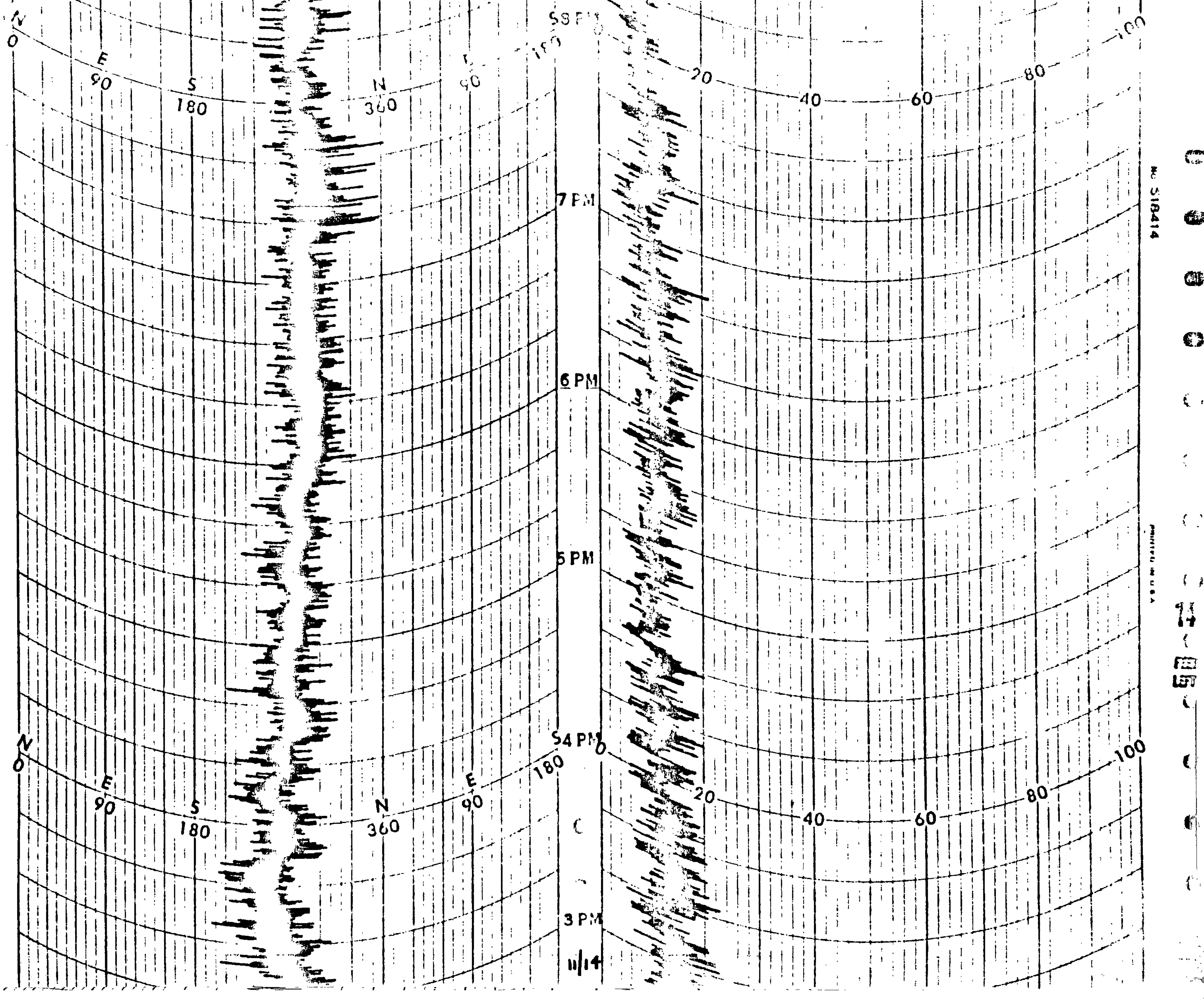

6 PM
5 PM
4 PM
3 PM
2 PM
N
0
E
90
S
180
W
270
N
360
180
0
20
40
60
80
100
11/15

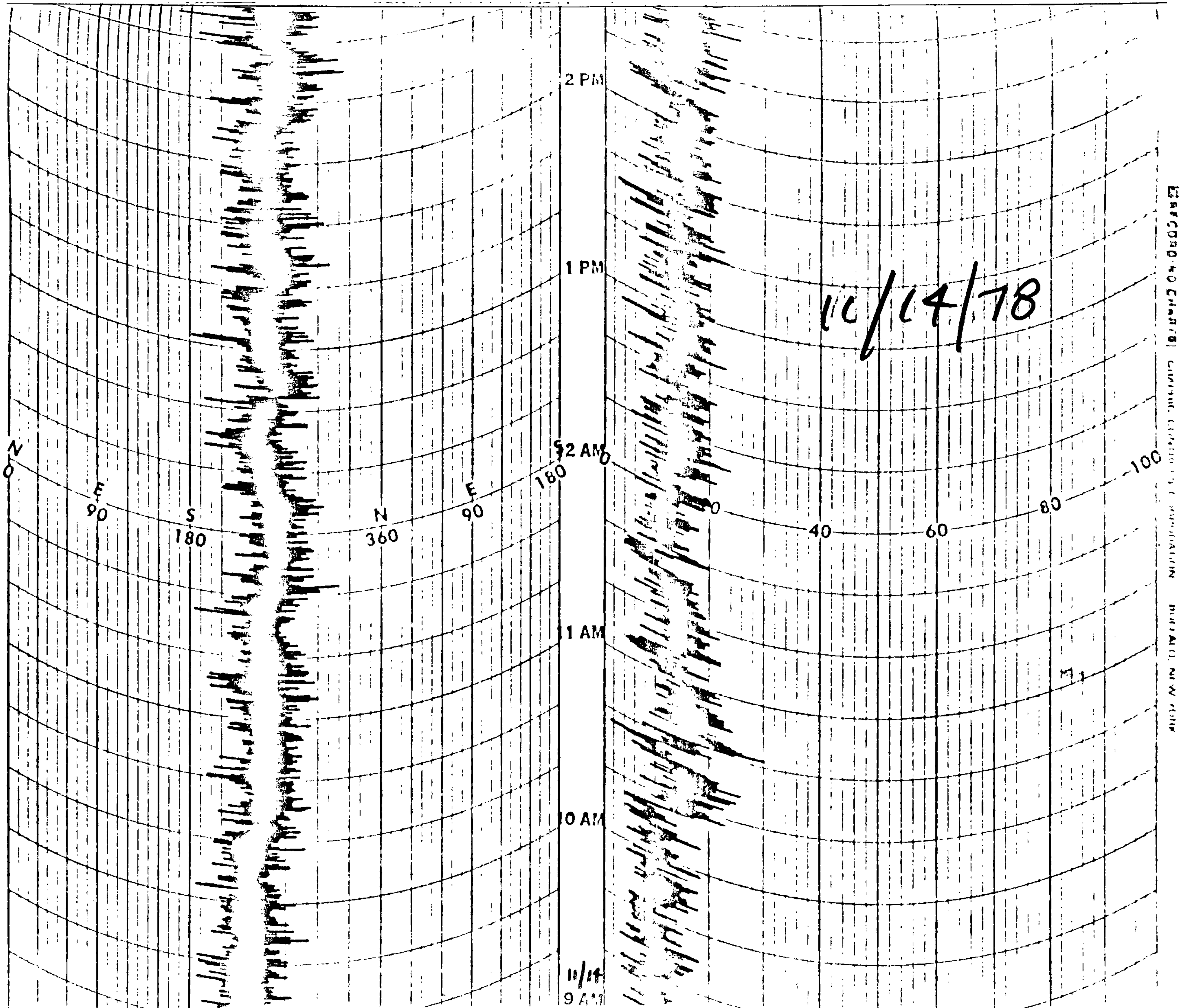

11/15/78
N
0
E
90
S
180
W
270
N
360
12 AM
180
1 AM
10 AM
9 AM
8 AM
11/15
20
40
60
80
100
GRAPHIC CONTROLS CORPORATION BUFFALO NEW YORK


7 A
6 AM
5 AM
4 AM
3 AM
2 AM
11/15
N
0
E
90
180
270
N
360
E
90
180
20
40
60
80
100

RECORDING CHARTS GRAPHIC CONTROLS CORPORATION BUFFALO, NEW YORK



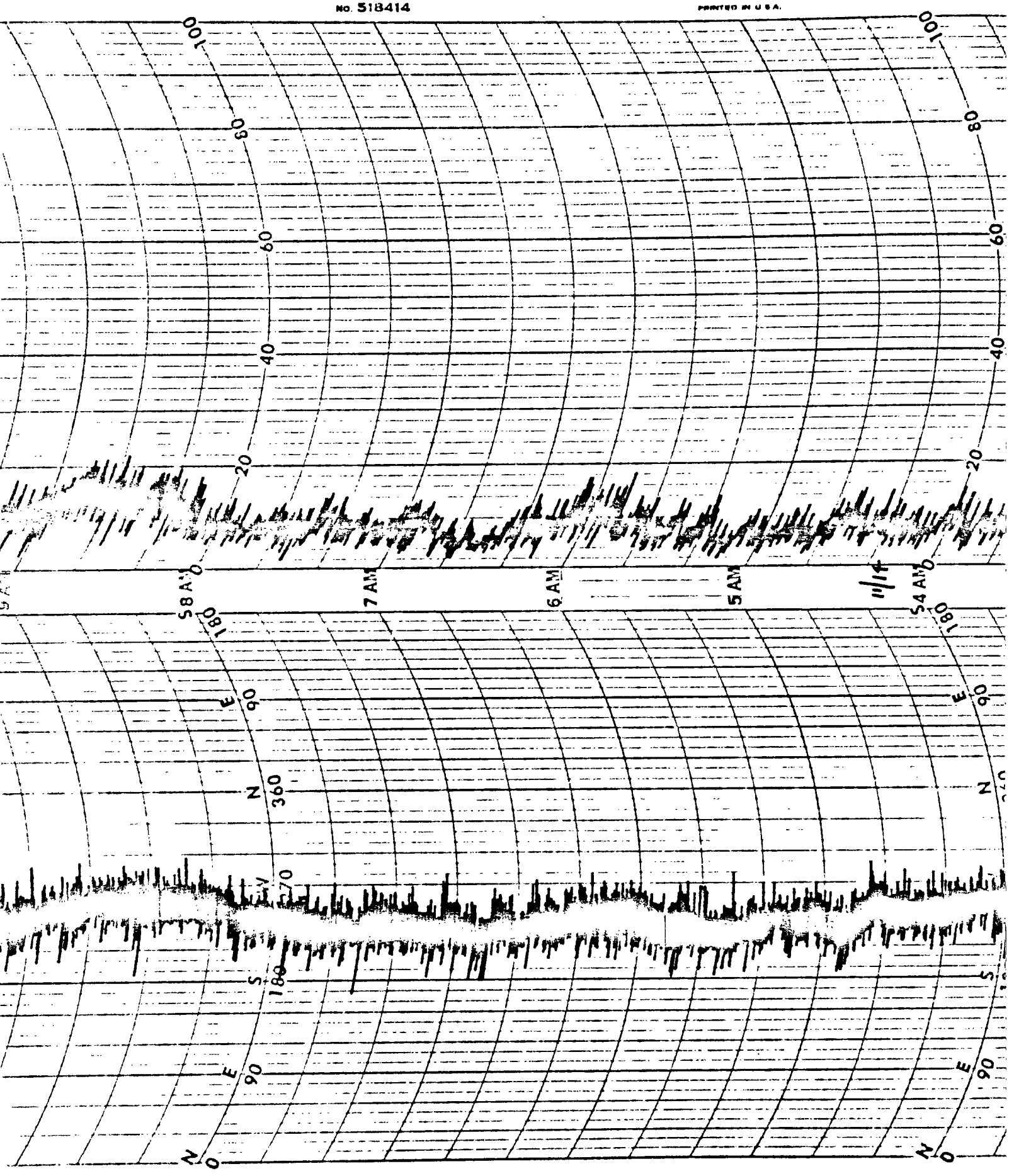

N
0
E
90
S
180
N
360
E
90
180
0
20
40
60
80
100
7 PM
6 PM
5 PM
4 PM
3 PM
11/14



2 PM
1 PM
12 AM
11 AM
10 AM
11/14
9 AM
N
0
E
90
S
180
N
360
E
90
S
180
0
40
60
80
100
11/14/78

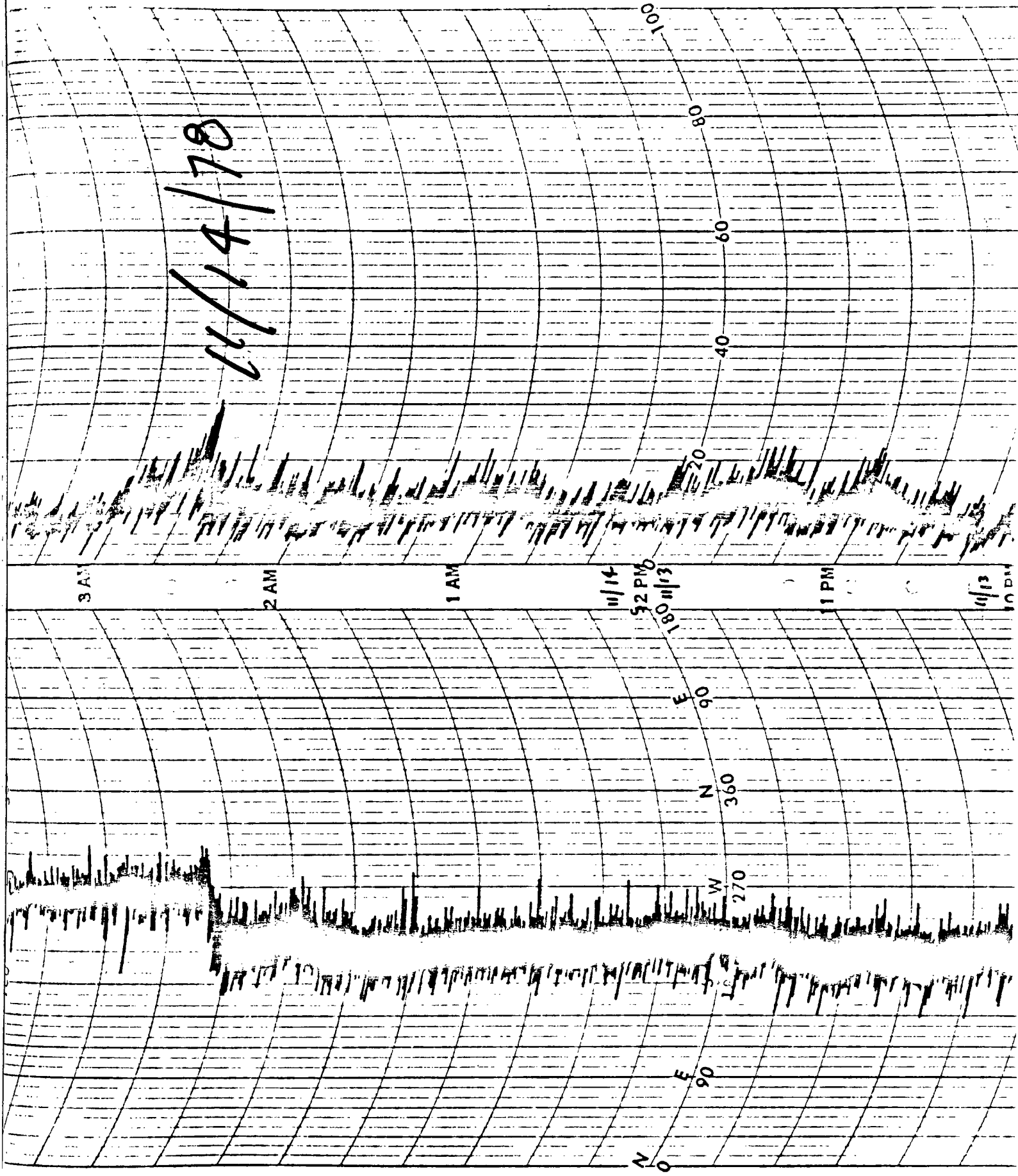
No. 518414

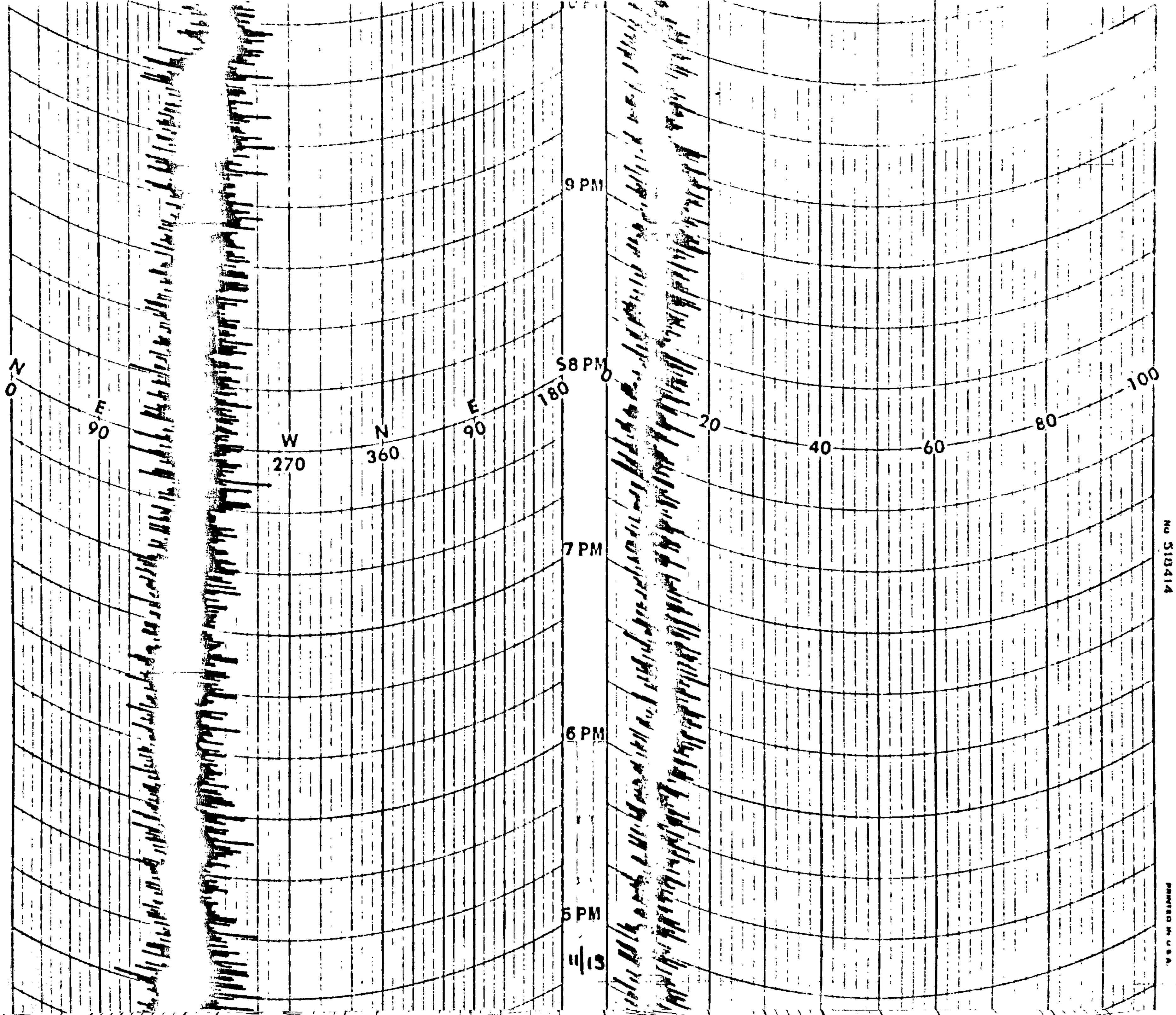
PRINTED IN U.S.A.

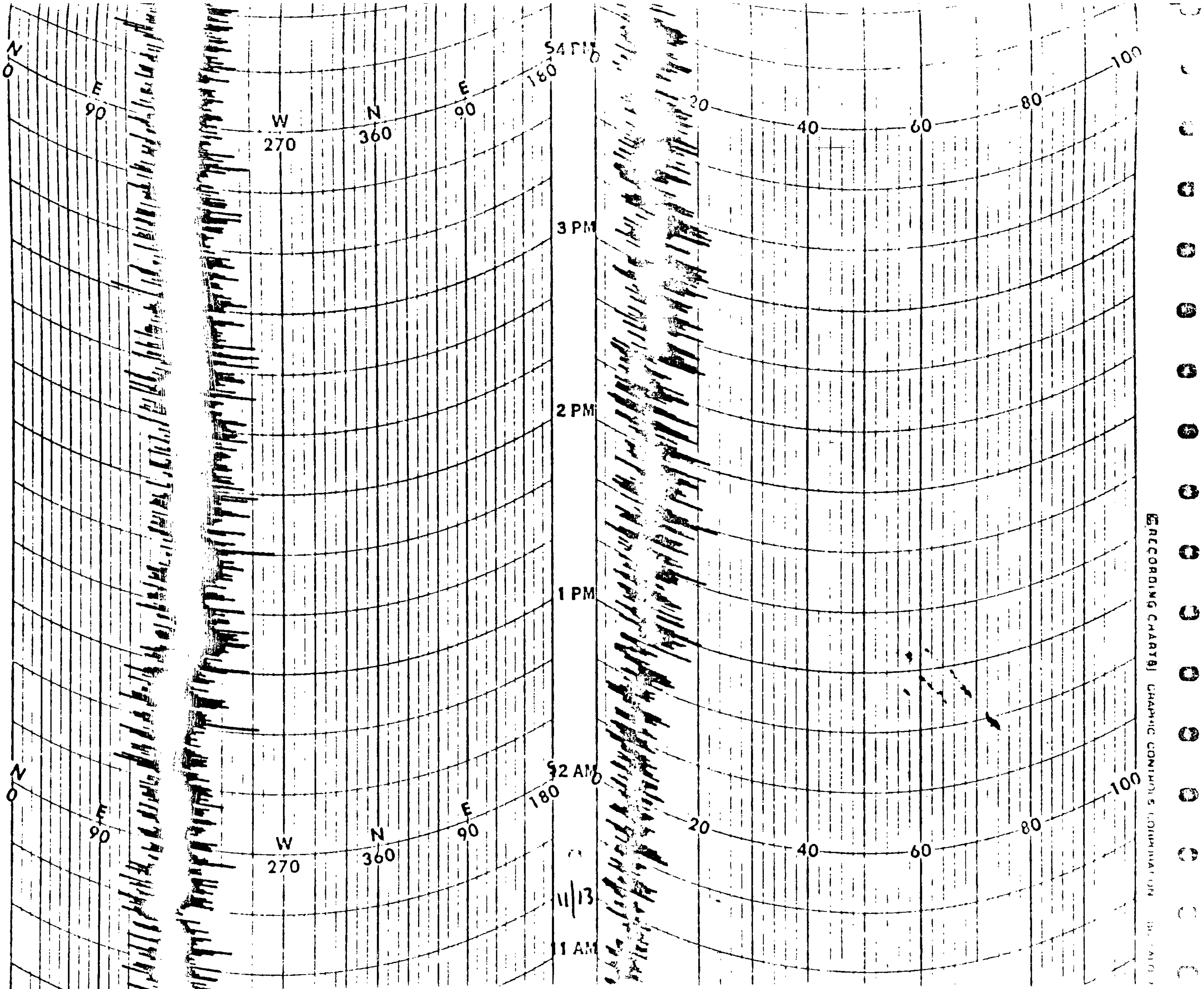


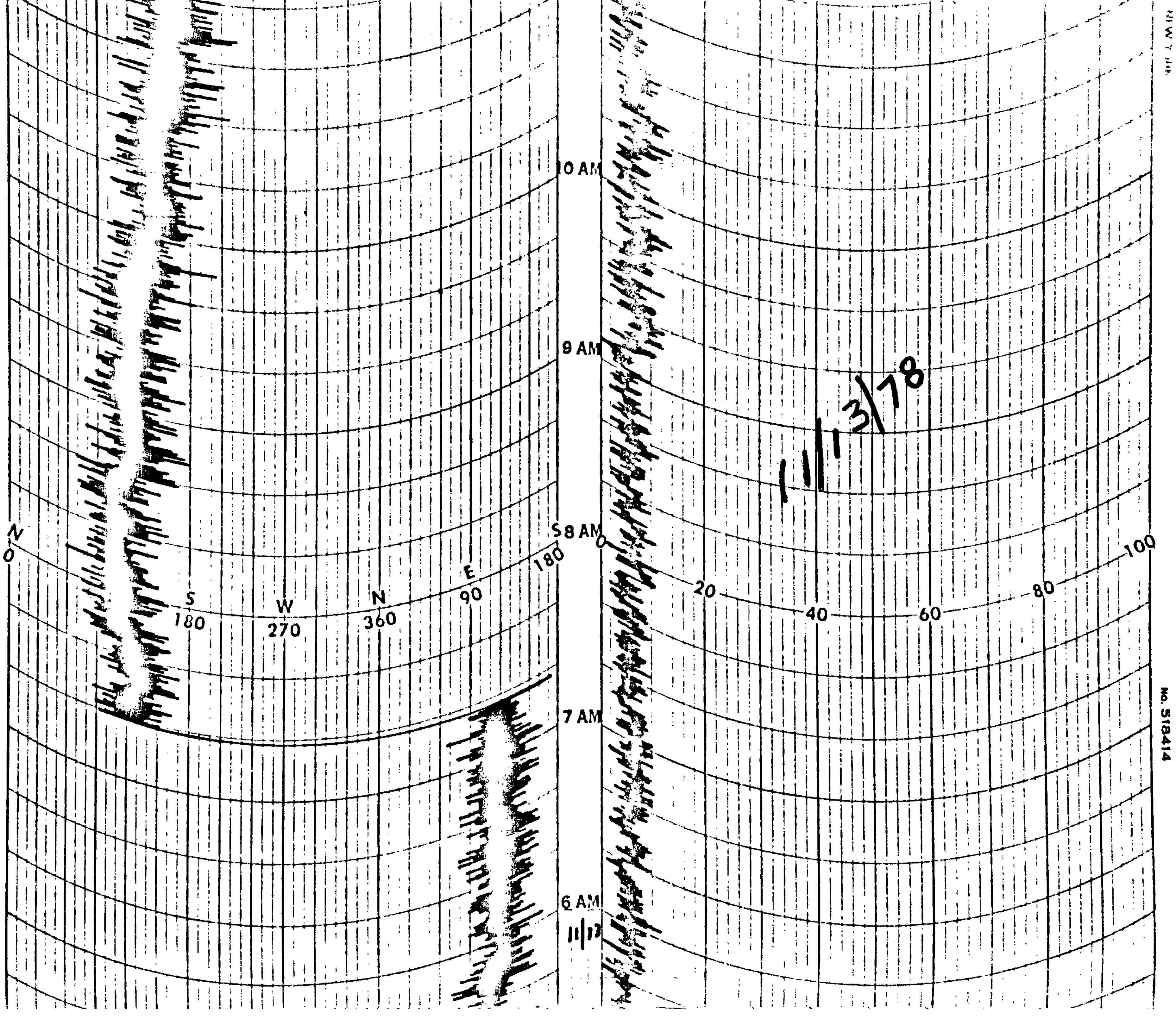
RECORDING CHARTS GRAPHIC CONTROLS CORPORATION BUFFALO, NEW YORK

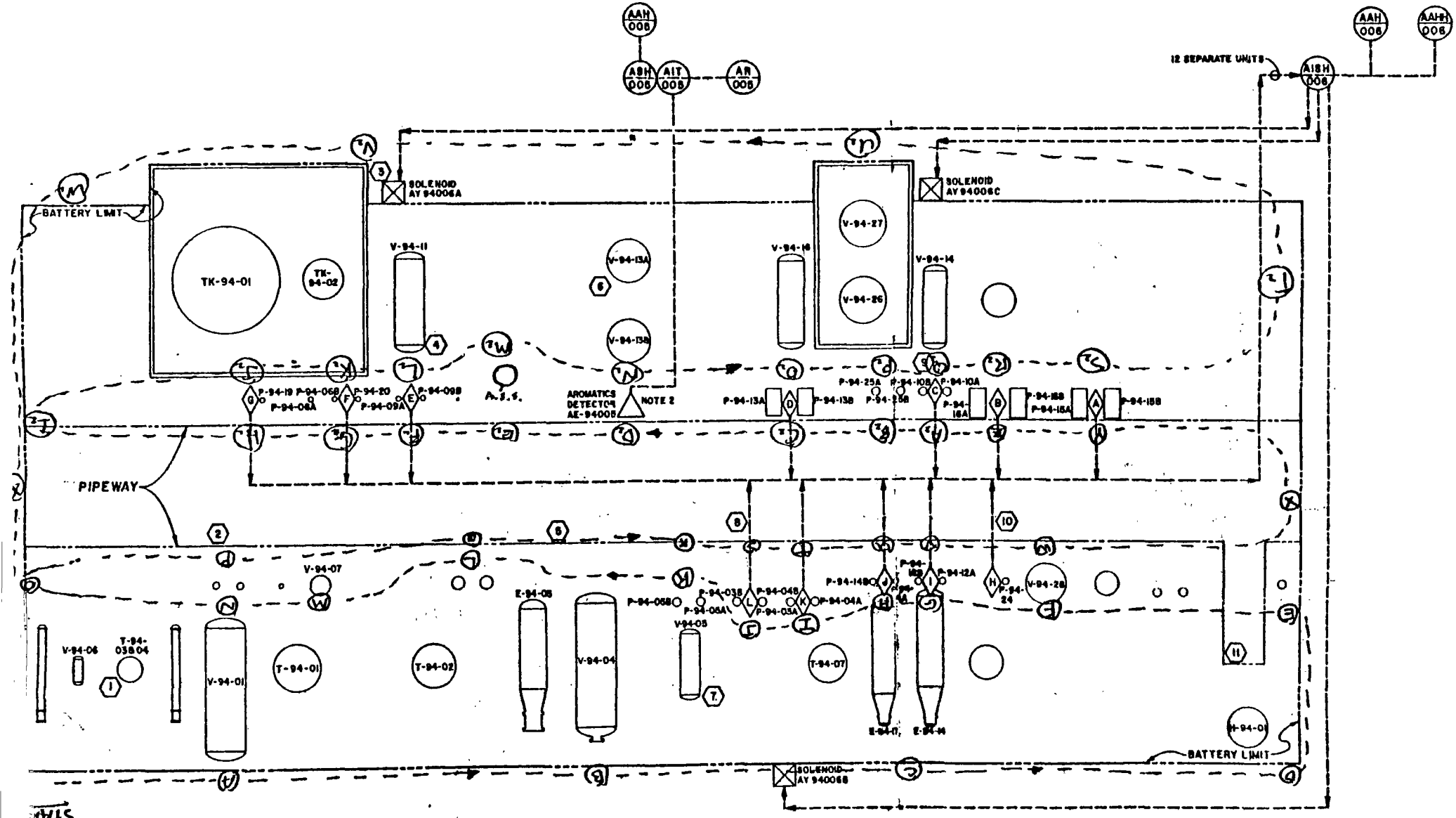
11/14/78




9 PM
8 PM
7 PM
6 PM
5 PM
11/13
N
0
E
90
W
270
N
360
E
90
180
0
20
40
60
80
100
No 513414
PRINTED IN U.S.A.


N
0
E
90
W
270
N
360
E
90
180
4 PM
20
40
60
80
100
3 PM
2 PM
1 PM
12 AM
11/13
11 AM


10 AM
9 AM
8 AM
7 AM
6 AM
N
0
S
180
W
270
N
360
E
90
S
180
0
20
40
60
80
100
11/13/78
11/13
No. 518414

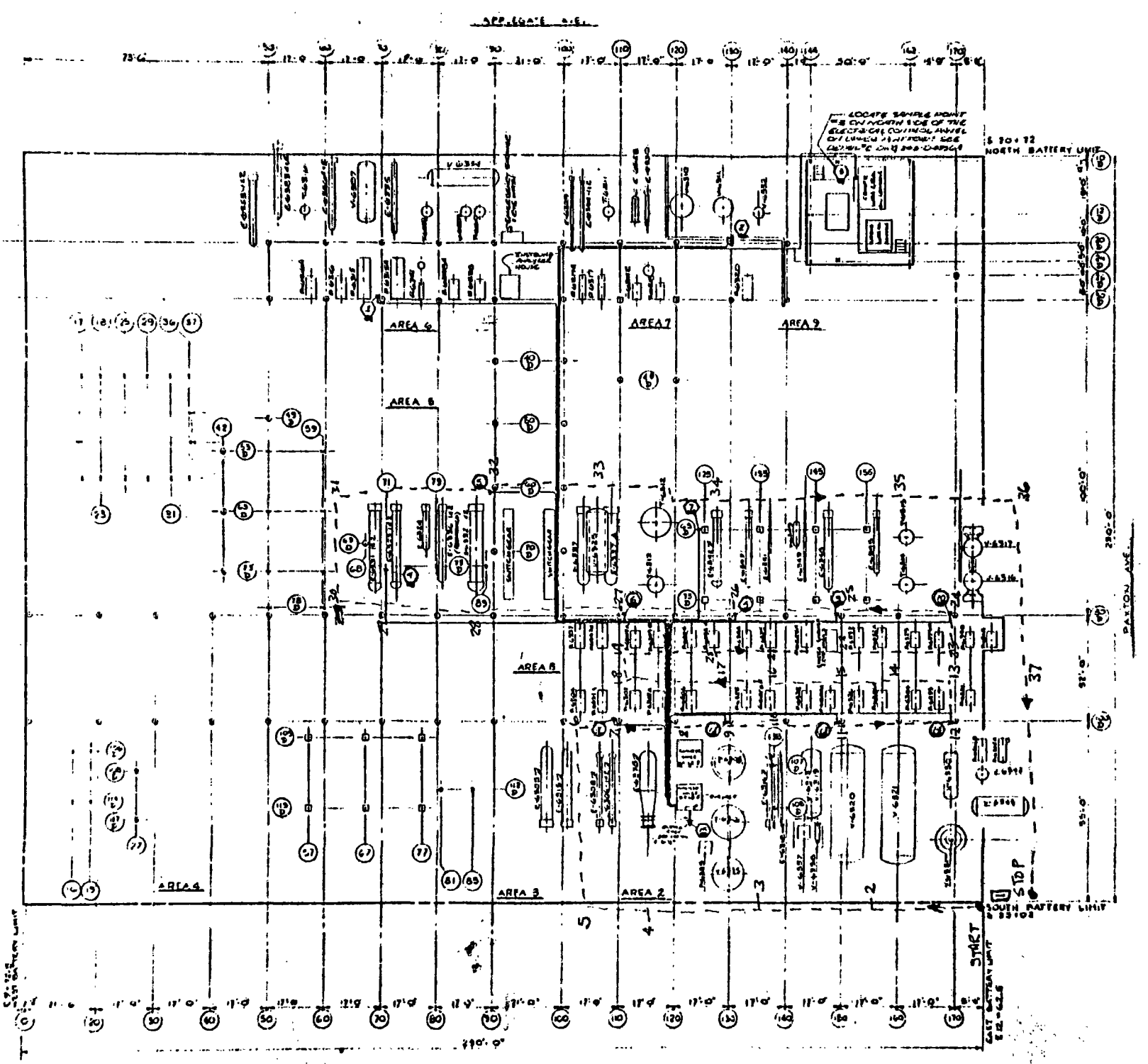


STM

START 950 1004
STOP 1002 1015

11-16-78

11



PLAN - PLT 6-8
TUBING RUNS FROM ANALYZER
SCALE: 1/16" = 1'-0"

GRID NO. 6-3

FACILITY SUN TOLEDO

PROCESS HDA

PAGE 1 OF 1	A	B
RECORDER	KCH	KCH
INST. OPERATOR	EGS	DCD
DATE	11-13-78	11-13-78
INSTRUMENT	OVA 108 1410	OVA-108 1691

5 min sample start 1340

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
6316-A-ON											PAD DRAIN
500	500					inlet	4500	3500	NC	NC	100
						outlet	300	>10,000			NC
						purge	1500	>10,000			
						Overhead	2000	500			
				PCV 63021 - PRODUCT GAS TO PLANT 4							
				>10000	>10,000		NC	NC			
						outlet	>10,000	>10000			
						bypass	3000	>10,000			
				PCV 63022							
				>10,000	>10,000		>10,000 NC	>10,000 NC			
6316-ON											
NC	100						70	2000	70	8000	
							NC	NC			
		INST. A READINGS QUESTIONABLE - PROBE FITTING CAME LOOSE & WITHER OR NO FLOW THROUGH INSTRUMENT									
							2000	5000	NC	NC	

GRID NO. 6-7

FACILITY SUN TOLEDO

PROCESS HDA

PAGE 2 OF 4	A	B
RECORDER	KCH	KCH
INST. OPERATOR	EGS	DCD
DATE	11-13-78	11-13-78
INSTRUMENT	OVA-108 1410	OVA-108 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
				LCV 63030							
							>10000	>10000			
					~~2000~~		600	7000			
				70.	NC		200	2000			
6315 - ON											
NC	NC	> 2 SEALS					600	1000	>10,000	>10,000 - LIQUID DRIP	
250	150						NC	NC	7000		
							NC	NC			
							1000	800			
							>10,000	8000			
							NC	NC			
				FCV 63081 - LIQUID SUPPLY							
				4000	2000		NC	NC			
6315-A	OFF - LIQUID DRIPS FROM SEAL										
2000	2000						NC	NC			
2500	1000 - LIQUID DRIPS						>10000	>10,000			
							NC	NC			
1435 OUT											

GRID NO. 6-3

FACILITY SUN TOLEDO

PROCESS HDA

PAGE OF 1	A	B
RECORDER	KCH	KCH
INST. OPERATOR	EGS	DCD
DATE	11-13-79	—
INSTRUMENT	OVA 103 1410	OVA 108 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
COMPRESSOR 1 LDH									N 7000 IRM C.C. TO POL		
									OUTLET VALVE LEAK		
INLET OUTLET FLANGE SMALL BLEED LINE						VALVES			S-27-000-401		
							8000				
							>10,000	1529 11-13-79	VAPOR SAMPLE *		
				TCV 63044							
				1500	800	BP	>10000	>10000			
						inlet	>10000	>10000			
						out	>10,000	>10000			
				TCV	63045						
				NC	NC	inlet	>10000	>10000			
						BP	NC	NC			
						outlet	>10000	>10000			
						overhead	>10000	>10000			
				LCV	63028						
				~~BCV~~	~~63120~~						
				4000	1000		300	>10,000			
							NC	NC			
							1500	700			
				FCV	63085						
				NC	NC						

GRID NO. 6-3

FACILITY SUN TOLEDO

PROCESS HDA

PAGE 41 OF 41	A	B
RECORDER	KAY	—
INST. OPERATOR	EGS	DCD
DATE	11-17-78	—
INSTRUMENT	OVA-108 1410	OVA-108 1691

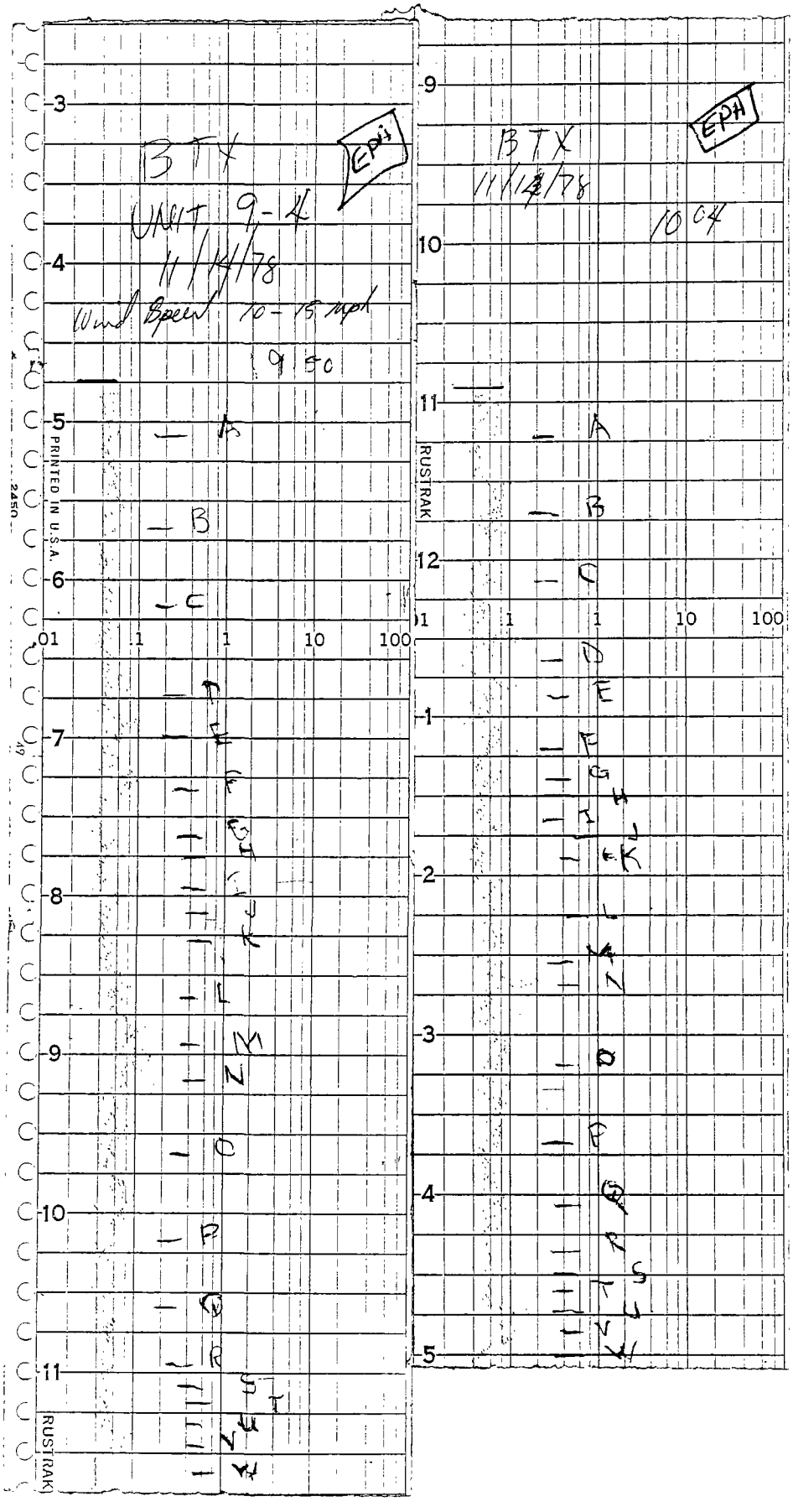
PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
				LCV 6100							
				NC	NC		NC	NC			
							NC	NC			
							10000	5000			

SUN OIL TOLEDO REFINERY
UNIT 9-4 - BTX
UNIT WALKTHROUGH
11-14-78

1 of 2

Repetition 1

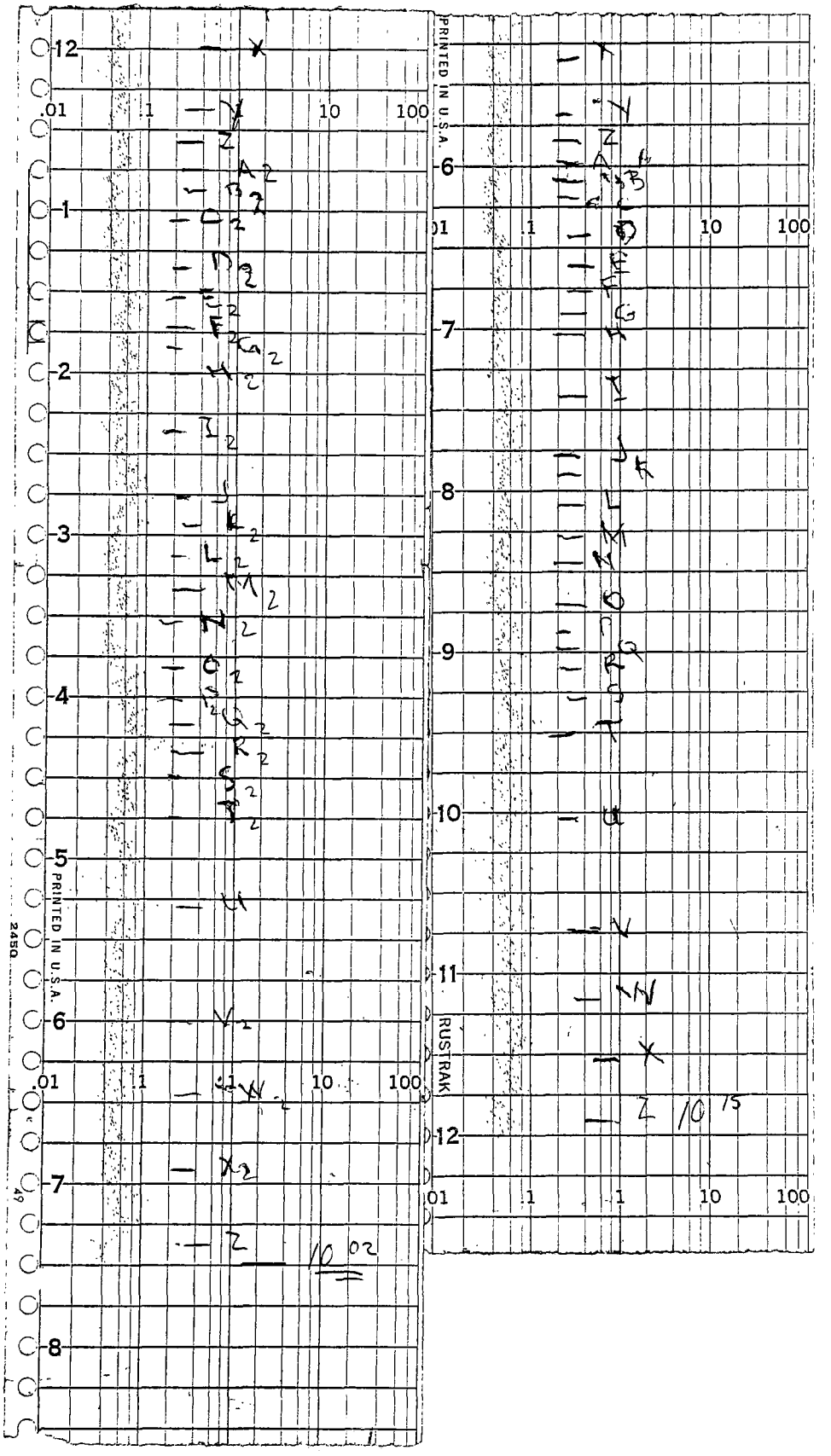
Repetition 2



SUN OIL TOLEDO REFINERY
UNIT 9-4 BTX
UNIT WALKTHROUGH
11-14-78
2 of 2

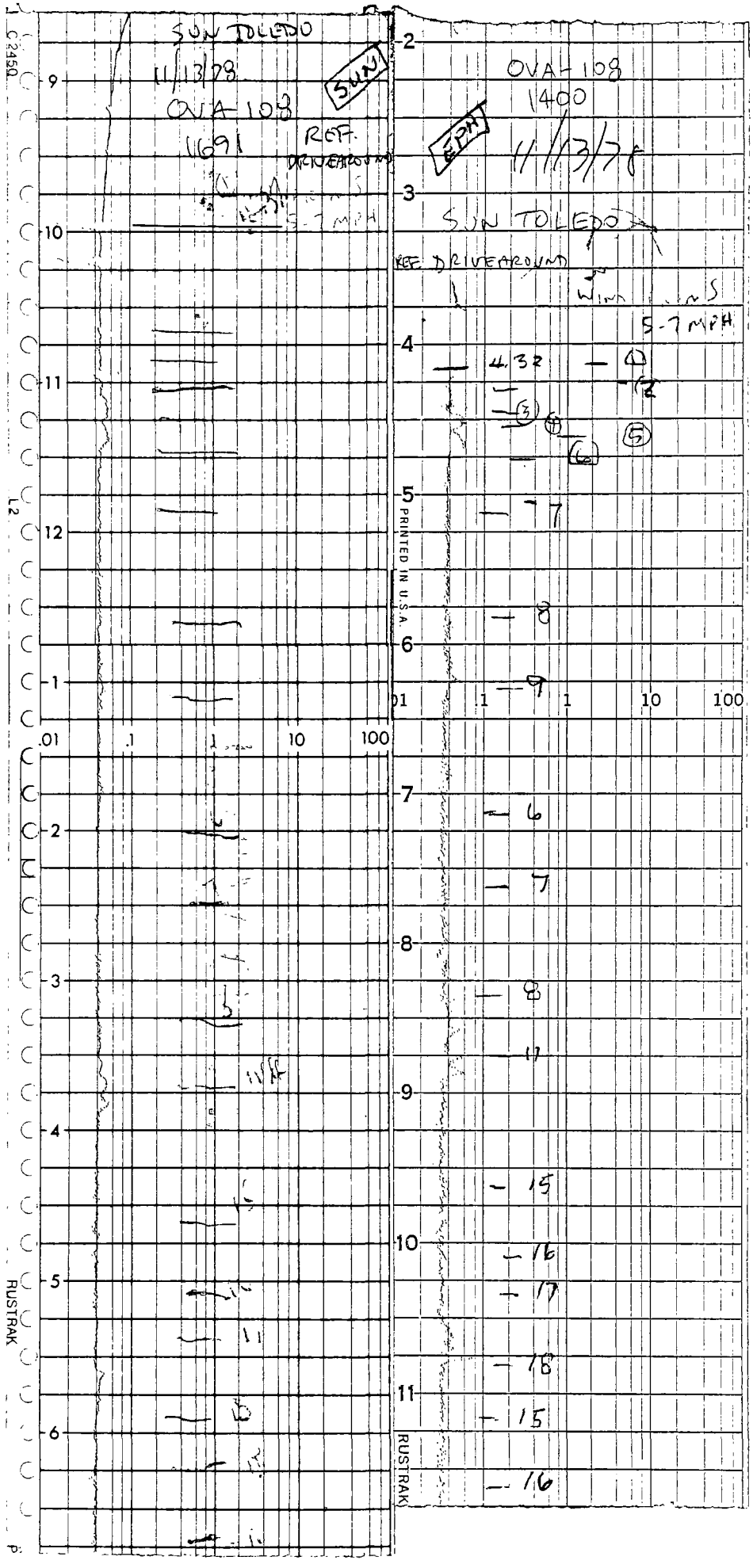
Repetition 1

Repetition 2



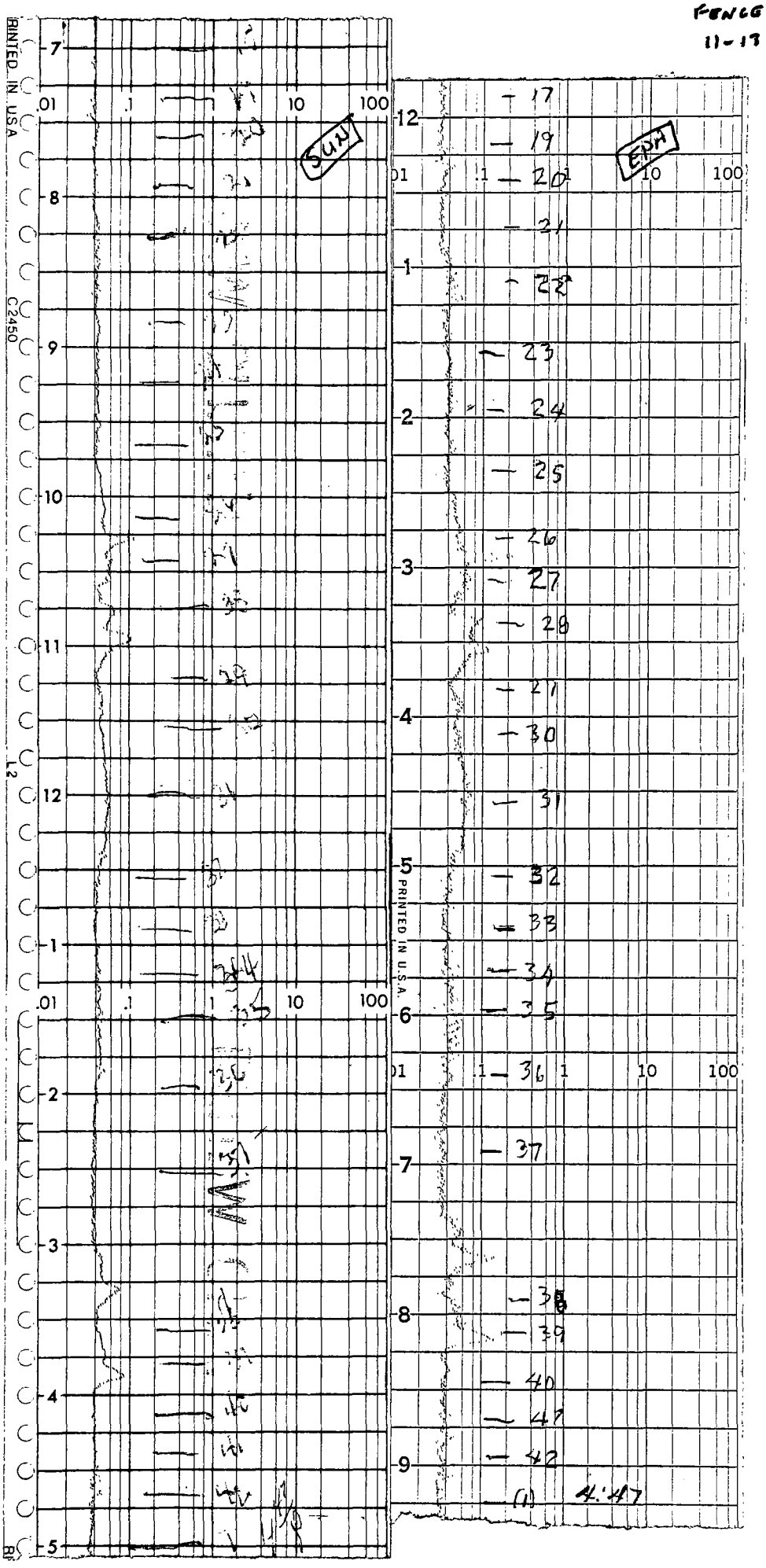
SUN OIL TOLEDO REFINERY
FENCELINE AMBIENT
11-13-78

1 of 2



SUN OIL TOLEDO REFINERY
FENCELINE AMBIENT
11-17-78

2 of 2



GRID NO. 9-4

FACILITY Sun Oil / Toledo

PROCESS Plant 94 fractionation (BTX)

PAGE 1 OF 11	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	D.D. (Sun)
DATE	11/14/78	11/14/78
INSTRUMENT	OVA 1410	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	9 AM:	Winds	From	West - S.West		10-15	MPH				
START	9:30 am										
	product(s)	valves		Tank Farm Gate		NC	NC				
					Gate	NC	NC				
					Small	NC	NC		2/NC	2/NC	all drain lines plugged
					Block	BO	SO				
					3 small	NC	NC		2/NC	2/NC	
					G	NC	NC				
					G	NC	NC				
					2 small	NC	NC		2/NC	2/NC	
					Block	NC	NC				
					Block	30	30				
	Control Valves		FV017	NC	NC		4/NC	4/NC	NC	NC	sample tap
			FV014	NC	NC		5/NC	5/NC			
			FR007	15	20		4/NC 1/NC	4/NC 1/NC	NC	NC	sample tap

GRID NO. 94

FACILITY Lion Oil/Toledo

PROCESS BTX Fract

PAGE 2 OF 11	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	DD
DATE	11/14/78	11/14/78
INSTRUMENT	OVA 1410	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	skipped V940										
	Tower T940 3804										
	LCV 015			NC	NC		9/NC	9/NC			
	FCV 015			NC	NC		3/NC	3/NC			
	LCV 014			NC	NC		6/NC	6/NC			
	Control Valve PCV 008			NC	NC		7/NC	7/NC			
	Pump (A) NC NC	on	mech				8/NC	8/NC			
	Pump (B) NC NC	off	mech				8/NC	8/NC			
	open pot under	V 9401			(open top)				5000	3000 (at vessel outlet plane)	
	Control Valve	FCV 003		(T 9401 8 HDS) NC	NC		3/NC	3/NC			
	Lean Oil line	C.V.		PV 042 NC	NC		8/NC	8/NC	12/NC	2/NC	

GRID NO. Plant 94

FACILITY Sun Oil / Toledo

PROCESS BTX Fract.

PAGE 3 OF 11	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	OD
DATE	11/14/78	11/14/78
INSTRUMENT	DVA 1910	DVA 1691

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
HX E9401											
~~FV001~~				150	150		3/NC	3/NC	* FEED PREHEATER		
FV001				FV001	FV001	outlet	>10000	>10000			
				NC.	NC		VAPOR SAMPLE 11-16-78				
Pump B C		off, mech		via accum of liquid			S-77-000-412				
NC	NC					Gate	2/NC	2/NC	NC	NC	
						Gate	NC	NC			
Pump D		on, mech									
NC	NC					Gate	NC	NC			
						Gate	NC	NC			
E9403 HX							2/NC	2/NC			
V9404 Vessel							2/NC	2/NC			
AM 2											
P9405B		on mech					4/NC	4/NC			stripping water
NC	NC										
P9405A		on mech					B				
NC	NC						3/NC	3/NC			

GRID NO. 94

FACILITY Sun Oil Toledo

PROCESS BTX Fract

PAGE 4 OF 11	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	DD
DATE	11/14/78	11/14/78
INSTRUMENT	OVA 1410	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
P 9403 B		off mech				gate	NC	15			
1500	1000						2/NC	2/NC			
P9403 A		on, mech				gate	3/NC	3/NC			◇ NC
NC	NC										
P9404 B		off mech		extractor recycle		outlet	(>10000	>10000)	liquid leak		◇ NC
NC	NC						2/NC	2/NC	NC	NC	
P9404 A		on mech					5/NC	5/NC	2/NC	2/NC	
100	100										
FV010				~~150~~ 80	150		3/NC	3/NC	NC	NC	
Control valve (next to LV021)		(unnumbered)		NC	NC	inlet	2000	—	2/NC	2/NC	extractor recycle
					*	outlet	200	200			
						BPass	>10000	>10000	* VAPOR	SAMPLE	stream
LV021				150	400		* 3/NC	3/NC	S-77-000-403		
									1038 - 11/14/78		
FV028				4500	7000		3/NC	3/NC	NC	NC	Toluene

S-77-000-404 Liquid sample EPA (DUR) 218

GRID NO. 94

FACILITY SunOil Toledo

PROCESS BTX Tract

PAGE 5 OF 11	A	B
RECORDER	Wek	Wek
INST. OPERATOR	EGS	DD
DATE	11/14/78	11/14/78
INSTRUMENT	OVA 1410	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	LV023										
				NC	NC		4/NC	4/NC	NC	NC	
Pump 94-14B on (mech)							4/NC	4/NC	NC	NC	Tol. Bot.
150	400										
Pump 9404A on, mech				liq leak							NC
>10000	4000						3/NC	3/NC			
Pump 9412B on				liq accumulator			2/NC	2/NC			Bz Bot
8000	8000										
Pump 9412A off							2/NC	2/NC			
NC	NC										
FV026 Control valve				NC	NC		3/NC	3/NC			
P9424 steam driven off							2/NC	2/NC			
NC	NC										

577-000-402 1046 11/14/78 VAPOR SAMPLE ~8000ppm

577-000-405 liquid sample EPA (DUR) 218

GRID NO. 94

FACILITY Sun Oil / Toledo

PROCESS RTX Fract

PAGE 6 OF 11	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	DD
DATE	11/14/78	11/14/78
INSTRUMENT	OVA 146	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
Control Valves											
LV 044				NC	NC		3/NC	3/NC	+	NC	
FV 055				NC	NC						
[Condensate Area] quick survey							no leaks found				
Product lines Ex cond. Area											
PV 022				NC	NC	Bypass	>10000	>10000			←
							2/NC				
PV 026A				NC	NC	side (left)	>10000	4000 (	for PSL 027		←
							2/NC	2/NC			
							4/NC	4/NC			
FV 057		Xlent		NC	NC						
FV 056		Xlent		NC	NC						
FV 059		Xlent		NC	NC						
FV 058		Xlent		NC	NC						
LV 026				NC	NC						
PV 024				NC	NC		3/NC	3/NC	NC	NC	
PV 023				NC	NC		3/NC	3/NC	NC	NC	
PV 022				NC	NC		NC	NC			

Break for lunch 11:00 am

GRID NO. 9-4

FACILITY SUN OIL / TOLEDO

PROCESS BTX

AFTER LUNCH 1335

PAGE 7 OF 11	A	B
RECORDER	KCH	KCH
INST. OPERATOR	EGS	DD
DATE	11/14/78	11/14/78
INSTRUMENT	OVA 1410	OVA 1691

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
	SOUTH END - NEXT TO SOLVENT TANK BARRIER -						WATER AREA -		PUMP 9407B		
	NO CHANGE ON ALL VALVES, PUMPS						ETC			9407A	
										9408A	
										9408B	
MP 9419 - SOLVENT CHARGE (ON)											
NC	NC						S/NC	(SOLVENT)			
MP 9406A - WET SOLVENT (ON)											
NC	NC						S/NC	(SOLVENT)			
MP 9406B											
NC	NC						6/NC	(SOLVENT)			
MP	9420 - HC SKIMMING PUMP (OFF)										
TO	100						10/NC				
											CLOSED END PROBE
MP 9409A - CLAY TOWER FEED											
NC	NC						2000 6/NC	4000 6/NC	LIQUID ON BOTT		1200 @ 1cm
MP	9409B										
NC	NC						1000 10/NC	300 10/NC	200		300 @ 1cm

GRID NO. 9-4

FACILITY SUN OIL / TOLEDO

PROCESS BTX

PAGE 8 OF 11	A	B
RECORDER	KCL+	KCL+
INST. OPERATOR	EGS	DD
DATE	11-14-78	11-14-78
INSTRUMENT	DVA 108 1410	DVA 108 1691

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
BELOW CLAY TOWER SURGE DRUM							3/NC	8/NC	60		
AROMATIC SOLVENT PUMP (ASS) MP 9421A											
(2 SMALL VERTICAL PUMPS)											
NC	NC	(OFF)					5/NC	5/NC			
NC	NC	(OFF)									
BLOCK VALVES (?)						→	2/NC	2/NC			
BETWEEN TWO CLAY TREATERS											WIND TOO VARIABLE FOR SCM reading 8000@1cm
							10,000 13/NC	10,000 13/NC	300	100	
							10/NC	10/NC			
BLOCK VALVES W/ V9429 - BENZENE											
							6/NC	6/NC			
				LV020 NC	NC		3/NC	3/NC			
				TV005 20	20		6/NC	6/NC			
				TV006 NC	NC		9/NC	9/NC			

GRID NO. 9-4

FACILITY SUNOIL TOLEDO

PROCESS BTX

PAGE 9 OF 11	A	B
RECORDER	KCH	KCH
INST. OPERATOR	EGS	DD
DATE	11-14-78	11-14-78
INSTRUMENT	OVA 108 1410	OVA 108 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	BENZENE CLAY TOWER AREA										
				INLET SAMPLE APP.			3/NC	3/NC			
				OUTLET SAMPLE			3/NC	3/NC			
	8			PV 013							
				NC	NC		4/NC	4/NC			
				PCV 21 (FEED TO CLAY TOWER)							
				40	NC		40	70			
							3/NC	3/NC			
	MP 9413 A (OFF) TOLUENE REFLUX										
1500	1000			(8000 @ 1 cm)							
							150	300			
	MP 9413 B (ON)						7/NC	7/NC			
400	400										
				2" FLOW CONTROL VALVE			5/NC	5/NC			
				(enclosed)							
							>10,000	1000	(4000 @ 1 cm — uv TO 70 @ 5 cm		
							5/NC	5/NC	in high variable winds)		
	MP 9425 A (ON) BENZENE TRANSFER										
NC	NC					bypass	>10,000	>10,000 40	300	300	
							13/NC	13/NC			

GRID NO. 9-4

FACILITY SUN TOLEDO

PROCESS BTX

PAGE 10 OF 11	A	B
RECORDER	KCH	KCH
INST. OPERATOR	EGS	DD
DATE	11-14-78	11-14-78
INSTRUMENT	OVA 108 1410	OVA 108 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	MP 9425 B (ON) BZ										
NC	NC					Sample valve	3000 NC	2000 70	100	100	
							6/NC	6/NC			
	MP 9410 A (OFF) BZ										
NC	NC						7/NC	7/NC			
	MP 9410 B (ON) BZ										
300	50 300						10/NC	10/NC	wet bench sample tap NC	NC	
	MP 9416 A (OFF) XYLENE TWR REBOILER FEED										
NC	NC										VISIBLE LEAK IN FLANGE HVY AROMATICS ~1000
						Inlet	NC	250 NC	(600 LCM)		
							3/NC	3/NC			
	MP 9416 B (ON)										
NC	NC						3/NC	3/NC			
				FCV 34 125	300		4/NC	4/NC			LIQUID LEAK FROM OVERHEAD ORIFICE METER 1 DROP/10 SECS

GRID NO. 9-4

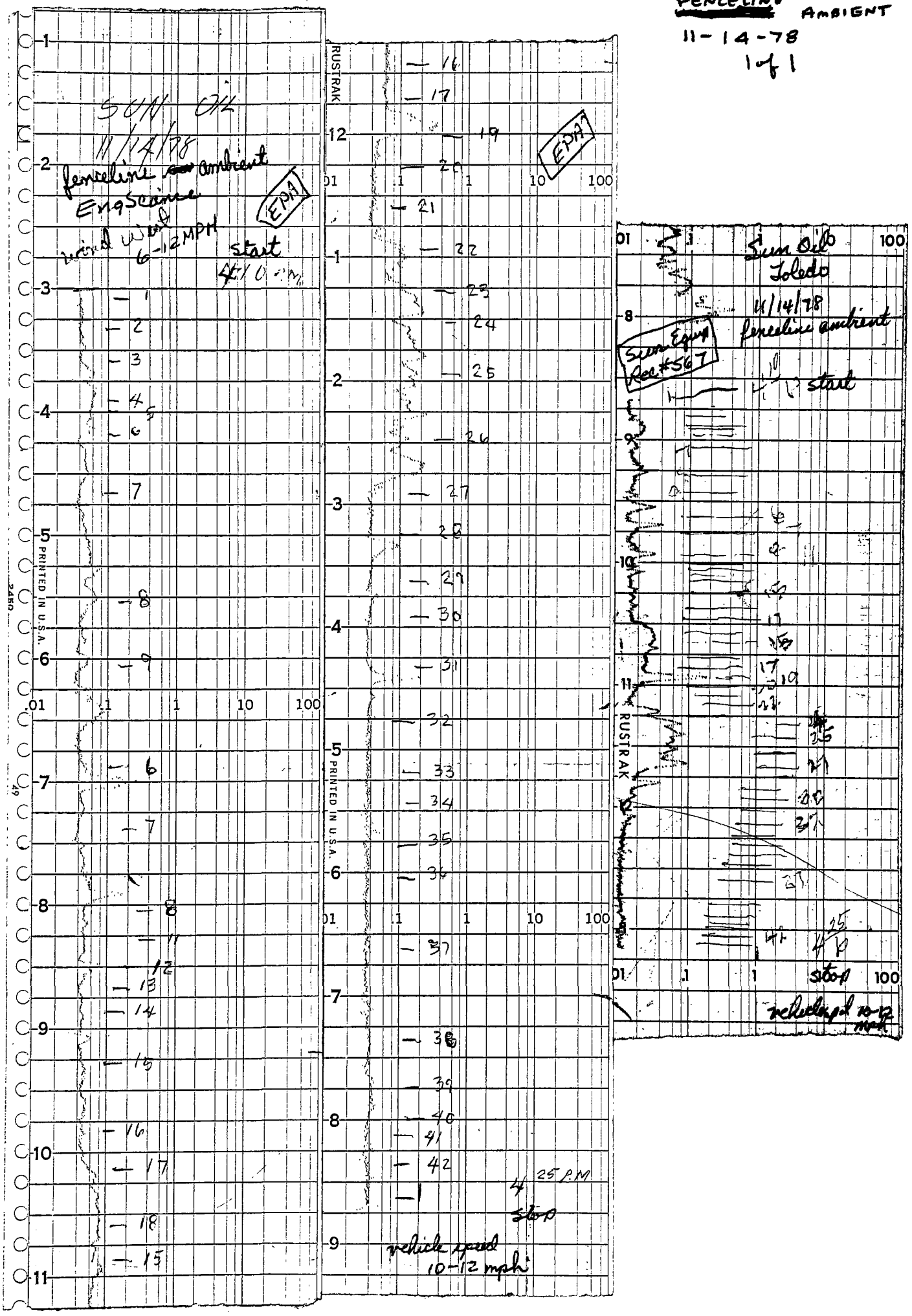
FACILITY SUN OIL TOLEDO

PROCESS BTX

PAGE 11 OF 11	A	B
RECORDER	KCH	KCH
INST. OPERATOR	EGS	DD
DATE	11-14-78	11-14-78
INSTRUMENT	OVA 10B 1410	OVA 10B 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	TOLUENE H.E.			LV 027 NC	200		8/NC	6/NC		NC	SAMPLE NC
	BENZENE H.E.			FCV. 900	200	(150 @ 1 cm)	7/NC	7/NC	2000		ORIFICE METER 200
	XYLENE H.E			LV 027 150	160		5/NC	5/NC	NC	NC	
MP 9415B (OFF) XYLENE 1600	1500						475 3/NC	400 3/NC			METER - LIQUID LEAK - XYLENE
MP 9415A (ON) 2500	800						7/NC	7/NC			GUAGE 70 - 150
	STOP 1524										

SUN OIL TOLEDO REFINERY
FENCELINE
AMBIENT
11-14-78
1 of 1



GRID NO. 63

FACILITY Sun Oil Toledo

PROCESS HDA

PAGE 9 OF 9	A	B
RECORDER	HSD	HSD
INST. OPERATOR	EGS	DP
DATE	11/16/78	11/15/78
INSTRUMENT	OVA	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
H.E # 4		E634					NC	1000			7 10000 leak on flanges
							NC	500			
				NC	NC		6/NC	6/NC			
HE # 5		OUT OF SERVICE.									
				NC					NC	NC	
Rebailer #1				NC	NC	63021	6/NC	6/NC			
							6/NC	6/NC			
Rebailer #2				NC	NC		NC	NC			
CLAY TOWERS							6/NC	6/NC			
							1500	2500			
							2000	2000	2000	3,000	
							7000	7 10000	File line	from P 63223	
							1/NC	1/NC			
							4/NC	4 NC			
				NC	NC		10/NC	10/NC			

GRID NO. 63

FACILITY Sun Oil Toledo

PROCESS HDA

PAGE 8 OF 9	A	B
RECORDER	HSD	HSD
INST. OPERATOR	EGS	DD
DATE	11/15/78	11/15/78
INSTRUMENT	CMK	CMK 1091

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
				LCB 63060 NC	NC		6/NC	6/NC			
							3,000	>10000			large valve
							4/NC	4/NC			
				NC	NC	63017	4/NC	4/NC	NC	NC	
H.E	#1						7/NC	7/NC			
				CV			3/NC	3/NC			
				FT 63056			700	700			
				>10000	>10000		>10000	>10000			
							1/NC	1/NC	small valve		
							2,000	10000			
							3,000	10,000			
							2/NC	2/NC			
							4/NC	4/NC			
H.E	#2						500	1500			
							>10000	>10000			
							4/NC	4/NC			
				NC	NC	63018	5/NC	5/NC			
HE	#3			NC	NC	63087	2/NC	2/NC	1/NC	1/NC	
							9/NC	9/NC			
							3/NC	3/NC			
									2000	5000	yellow natural pipe

GRID NO. 63

FACILITY Sun Oil Toledo

PROCESS HDA

PAGE 7 OF 9	A	B
RECORDER	HSD	HSD
INST. OPERATOR	EGS	DD
DATE	11/5/78	11/15/78
INSTRUMENT	OVA 14	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
6337 A OFF NC						NC	all valves				
6337 OFF NC							5/NC	5/NC			
				NC	NC (63033)		6/NC	4/NC			
				NC	NC (63094)		500	2000			
							2/NC	2/NC			
pump 6309 OFF NC							6/NC	4/NC			
							4/NC	4/NC			
pump 6309 A OFF 6305						NC	all valves				
							8/NC	8/NC			
				NC	NC (63028)		2/NC	2/NC			4/NC
				NC	>10000 (63012A)		>10000	>10000	(2 bottom valves)		
							>10000	>10000			
							3,000	2000			
							8/NC	8/NC			
				NC	NC (63027)		All valves	w/NC	PCV 63027 NC		

GRID NO. 63

FACILITY Sun Oil / Toledo

PROCESS HDA

PAGE 6 OF 9	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	DD
DATE	11/15/78	11/15/78
INSTRUMENT	OVA 14	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
pump 6333 A OFF				2/11	2/NC		5/NC	5/NC	300	400	
NC	NC						6/NC	6/NC	>10000	>10000	
pump 6324 OM							900	700			
NC	NC						400	400			
							>10000	3000			
							200	200	Recont	NRE	
				3000	>10000 (6304B)		2/NC	4/NC			
							6/NC	6/NC			
pump 6369B OM		splitter Bottoms (B2)					200	300			
>10000	10000						3/NC	3/NC			
				>10000	10000		300	500			
							NC	500			
							100	200			
							2/NC	2/NC			
pump 6309 A											
N.C	N.C						2/NC	2/NC			
							100	100			
							3/NC	3/NC			
							NC	300			
							1/NC	1/NC	2/NC	2/NC	
				NC	NC		6/NC	6/NC			
				NC	NC		7/NC	7/NC			

GRID NO. 63

FACILITY Sun Oil / Toledo

PROCESS HDA

PAGE 5 OF 9	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	DD
DATE	11/15/78	11/15/78
INSTRUMENT	OVA 14	OVA 1691

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
pump 25A	0325A	OFF									
~~100~~				1000	5000		~~1000~~	~~4000~~	Charge	valve	
1000	600			2/NC	2/NC		700	4000			
							3/NC	3/NC			
							3/NC	3/NC			
							~~100~~ 200	200			
							300	300			
							2/NC	2/NC			
	pump 0325	ON									
25A											
300	200			5,000	5,000		6000	6000			
		B2 Tower Reflux		7000	7/10000		7/10000	7/10000	2/NC	2/NC	
		(B2)					1000	1000			
							4/NC	4/NC			
pump 6332		ON									
1500	3000			1500	2000		2/NC	2/NC			
							4/NC	4/NC	NC	NC	
	polymer to storage			20	200		200	150	rerun	reboiler	
							3/NC	3/NC			
							3000	7/10000			
							7/10000	7/10000			
							7/10000	7/10000			
							2/NC	2/NC			

GRID NO. 63

FACILITY Sun Oil / Toledo

PROCESS HDA

PAGE 4 OF 9	A	B
RECORDER	W2K	WEK
INST. OPERATOR	EGJ	DP
DATE	11/15/78	11/15/78
INSTRUMENT	OVA #14	OVA 1691

Restart: 1:00 pm.

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
Pump 630 S						~~4"NC~~	4"NC	4"NC			
Pump 6330											Not working
Pump 6329A											
1000	900						6"NC	6"NC	1"NC 2500	1"NC 2500	
Pump 6329							6000 4"NC	200 4"NC			
2000	600								3"NC 2000	3"NC 1500	open ended line bottom portion
6322 A NC				1500	1500		5"NC	5"NC			
							300 3"NC	500 3"NC			
~~6322~~ NC				NC	NC		4"NC 1"NC 3"NC	4"NC 1"NC 3"NC	NC		
6395		~~300~~	~~600~~	~~3300~~	~~6600~~		900 150	1000 400			1" C

GRID NO. 63

FACILITY Sun Oil/Toledo

PROCESS HDA

PAGE 3 OF 9	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	DD
DATE	11/15/78	11/15/78
INSTRUMENT	OVA 14	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
Pump 63223A, off											
100 ~~ppm~~	NC						3/NC	3/NC			
Control valves, (no number)				NC	NC		1/NC	1/NC			
FCV 63038				150 ~~PPM~~	NC		3/NC	3/NC			
FT 63038				NC	NC						
FCV 63021				NC	NC		3/NC	3/NC			
E63167 HX							12/NC	12/NC			may be out of service
V6313							3/NC	3/NC			
							>10000	>10000	from vessel in front of V6313 to Cape Overhead location		
all fittings above ground level not done; on second level							Most valves on vessels				
		Break at 1045									

GRID NO. 63

FACILITY Sun Oil / Toledo

PROCESS HDA

PAGE 2 OF 9	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	OD
DATE	11/15/78	11/15/78
INSTRUMENT	OVA 94	OVA 1691

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
Pump 6326		A on	liq drip				+	900			
							5/NC	7/NC			
>10000	>10000	B2	tower reflux				400	700			
			(B2)				—	900			
							—	300			
Pump 6326		off						6/NC			
7000	9000										
Level Control Valve											
LCV @ 63050				NC	NC		3/NC	3/NC			
Pump 6328		A off					250	800			
>10000	>10000		splitter reflux				>10000	>10000	outlet valve		
			(B2) & Toluene				11/NC	1/NC			
							+	3000	—		
							—	1500	—	>10000	& liquid drip
Pump 6328		on					1500	1000			
							>10000	>10000	valve on drain		
300	500						500	+		NC	
							4000	9000			
							1500	3000			
							3/NC	3/NC			

GRID NO. 63

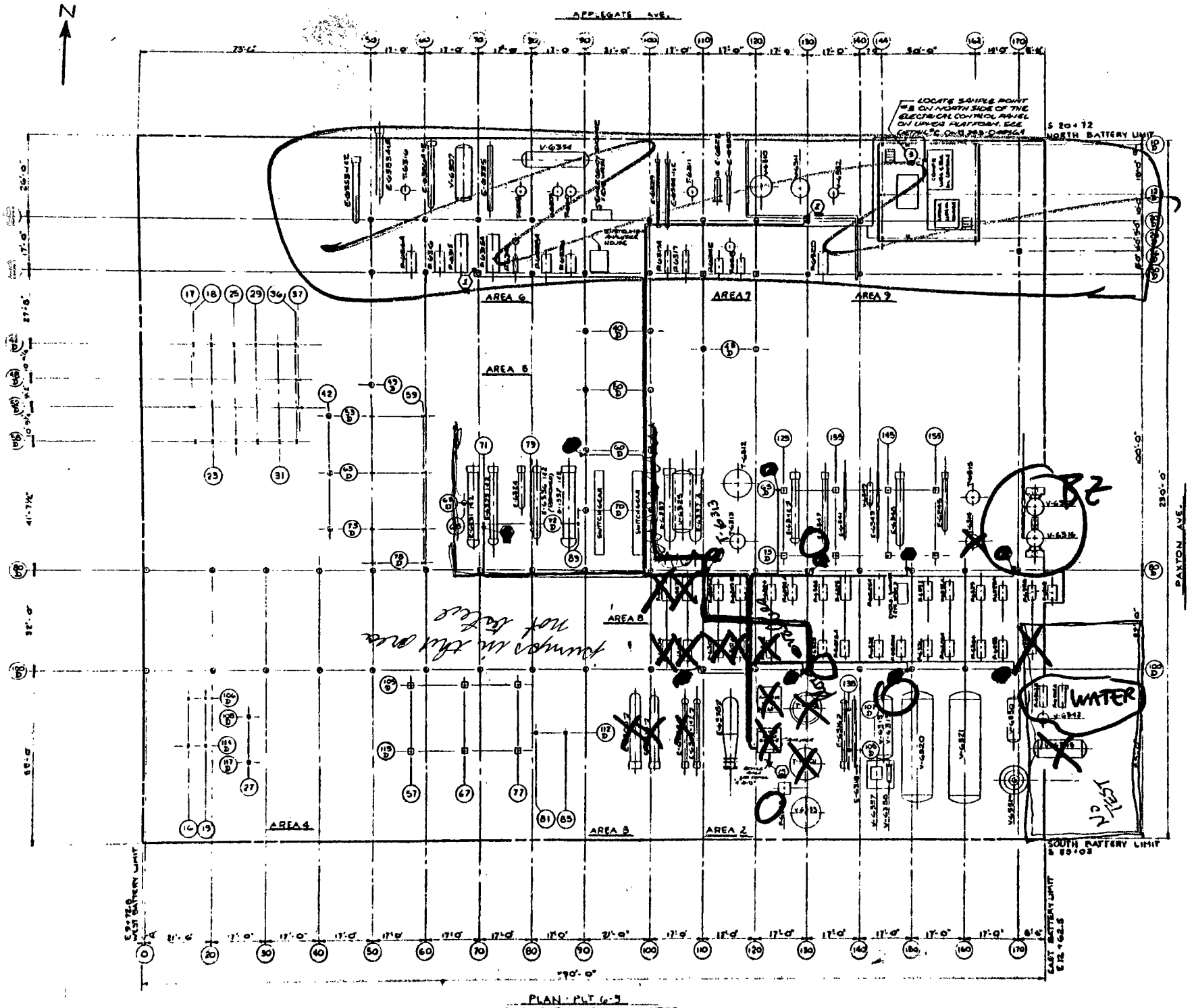
FACILITY Sun Oil | Toledo

PROCESS HDA

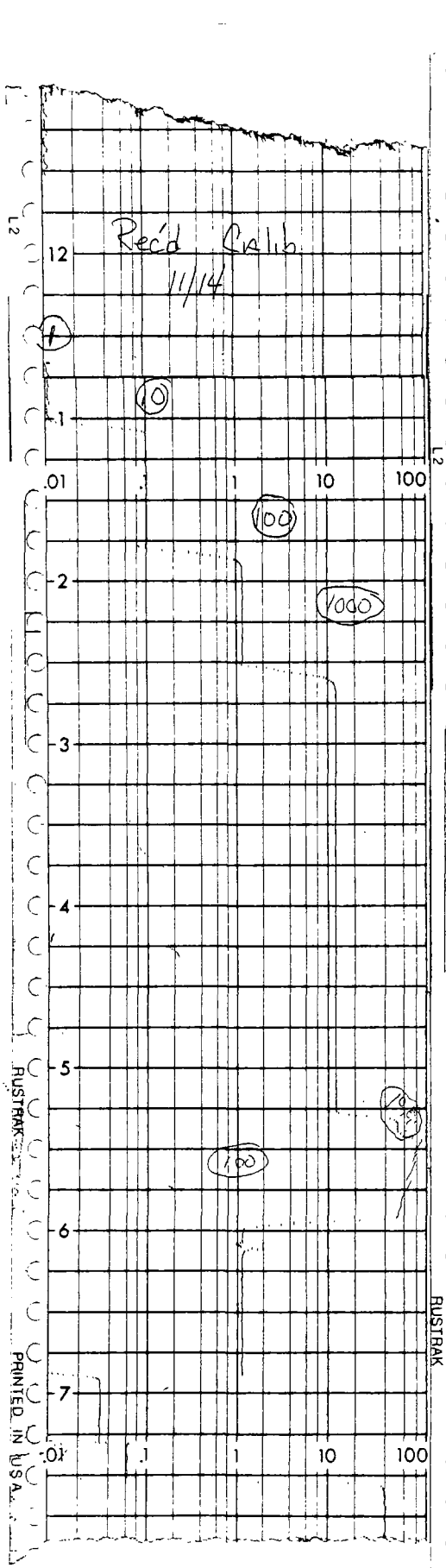
PAGE 1 OF 9	A	B
RECORDER	WEK	WEK
INST. OPERATOR	EGS	DD
DATE	11/15/78	11/15/78
INSTRUMENT	OVA 14	OVA 1691

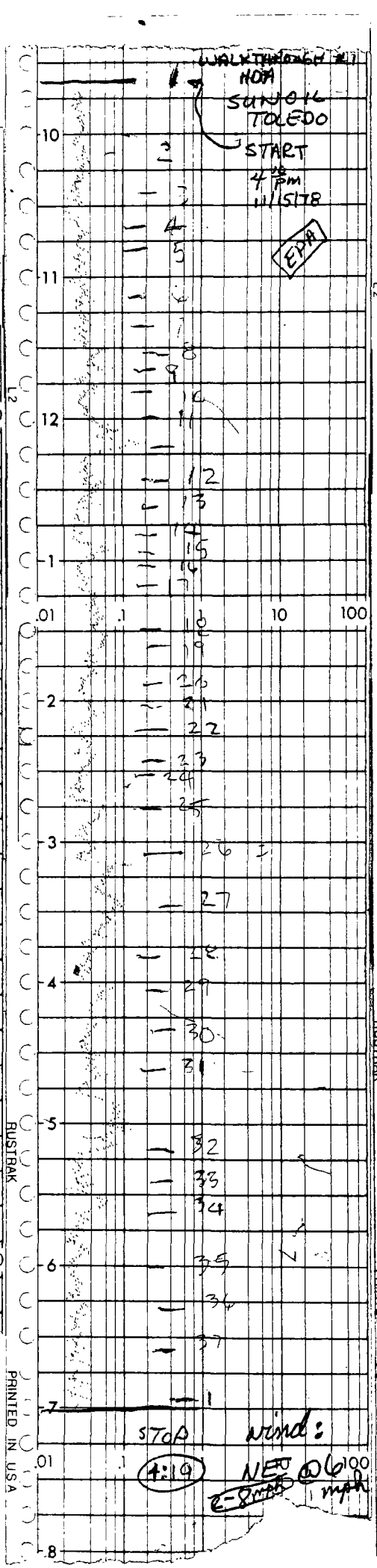
Start 0915

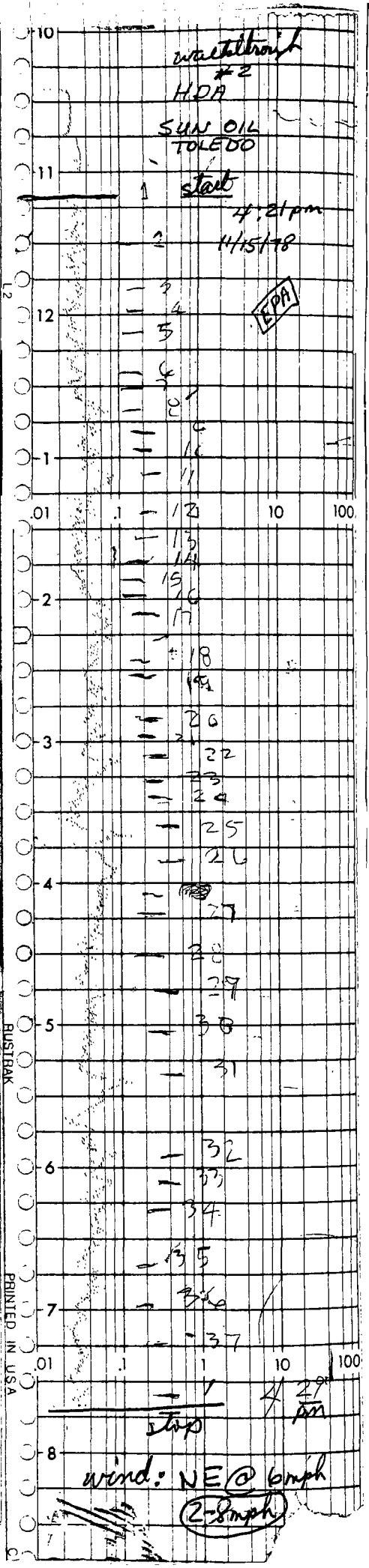
PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
Pump 6335		ON				TO OFF MARK	TEST 1500	1500			
1500	1000						250	200			
							7/NC	7/NC			
	B2	to storage					900	2000			
		(B2)					—	200			
							1000	800			
							200	30			
							500	200			
							3/NC	3/NC			
							6000				
							~~>10000~~	>10000	valve to P gage on pump outlet		
						lock			NC	NC	
							1000	>10000	main inlet valve		
							2000	6000	side inlet line valve		
Pump 6334		on						7/NC			
7000	4500						—	>10000	main inlet valve		
							—	300	—	80	
	B2	to storage					—	200			
		(B2)					—	3500			
							~~>10000~~ 400		valve / to storage line		
							>10000		side top		
							>10000		lower main valve to storage		
							—	1500			
							—	150			
							—	300		100	



PLAN - PLT 6-9
TUBING RUNS FROM ANALYZER
SCALE: 1/16" = 1'-0"


Recd Calib
11/14
10
100
1000
100
RUSTRAK
PRINTED IN USA


WALKTHROUGH #1
HDA
SUN OIL
TOLEDO
START
4:28 pm
11/15/78
EPA
STOP
4:19
wind:
NE @ 6 mph
2-8 mph
RUSTRAK
PRINTED IN USA


walkthrough #2
HDA
SUN OIL
TOLEDO
start
4:21 pm
11/15/78
EPA
stop
4:29 pm
wind: NE @ 6 mph
2-8 mph
RUSTRAK
PRINTED IN USA

GRID NO. 6-3

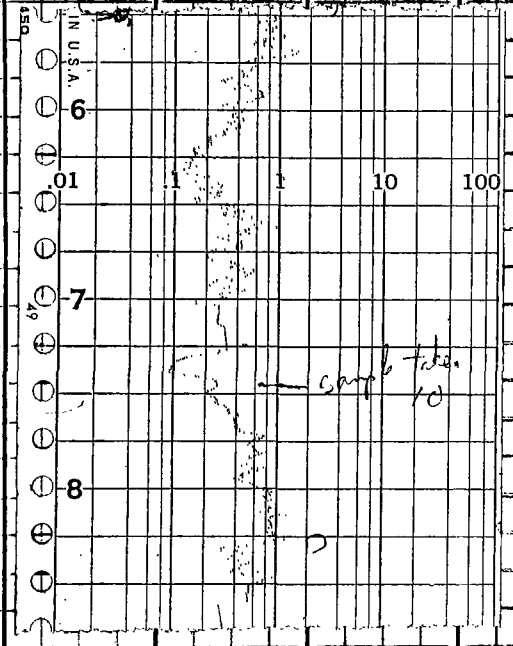
FACILITY SUN OIL TOLEDO

PROCESS HDA

PAGE 1 OF 1	A	B
RECORDER	KCH	
INST. OPERATOR	HUMBERT	
DATE	11-15-78	
INSTRUMENT	OVA-108	

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
VAPOR SAMPLE EPA (DUR) 218 S-77-000-406				1001							

AMBIENT VAPOR SAMPLE NEAR PUMP 6325 (T12 REFLUX)



GRID NO. [redacted]

FACILITY [redacted] TOLEDO

PROCESS WASTEWATER SEPARATOR

EAST

PAGE 1 OF 1	A	B
RECORDER	KCH	
INST. OPERATOR	WEK	
DATE	11-17-78	
INSTRUMENT	OVA-10%	

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			DRAIN		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
S-77-000-421 VAPOR SAMPLE						time: 1459 11-17-78					
				S-77-000-425 liquid							
WASTEWATER SEPARATOR FOREBAY						@ GROUND LEVEL	~3'	ABOVE	LIQUID	LEVEL	
S-77-000-422 VAPOR SAMPLE						time: 1508 11-17-78					
WASTEWATER SEPARATOR OUTFALL						@ GROUND LEVEL	~5'	ABOVE	LIQUID	LEVEL	
S-77-000-426 liquid											

EPA (DUR) 215

GRID NO. 9-1

FACILITY SUN OIL / TOLEDO

PROCESS GASOLINE BLENDING COMPONENTS

PAGE 1 OF 2	A	B
RECORDER	Kent	
INST. OPERATOR	WEEK 11-15-78	
DATE		
INSTRUMENT	ONA 108	

PUMP SEAL	COMP. SEAL	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
S-77-000-431	liquid								
S-77-000-407 VAPOR SAMPLE EPA (DUR) 215		1350		AMBIENT	50-500				
VAPOR SAMPLE #1 DEBUT BOTTOMS UNIT 4-1				SAMPLE	>10,000 ppm				
S-77-000-432	liquid								
S-77-000-408 VAPOR SAMPLE EPA (DUR) 215		1355		AMBIENT	100 ppm				
#1A DEBUT BOTTOMS UNIT 4-1				SAMPLE	>10,000 ppm				
S-77-000-409 VAPOR SAMPLE		1400		AMBIENT	20 ppm				
S-77-000-433	liquid								
#2 DEBUT BOTTOMS UNIT 4-1				SAMPLE	>10,000 ppm				
S-77-000-410 VAPOR SAMPLE		1408		AMBIENT	10 ppm				
S-77-000-434	liquid								
MEROX PRODUCT (~20 lb VAPOR PRESSURE)				SAMPLE	~1000 ppm				

GRID NO. 6-1

FACILITY SUN OIL TOLEDO

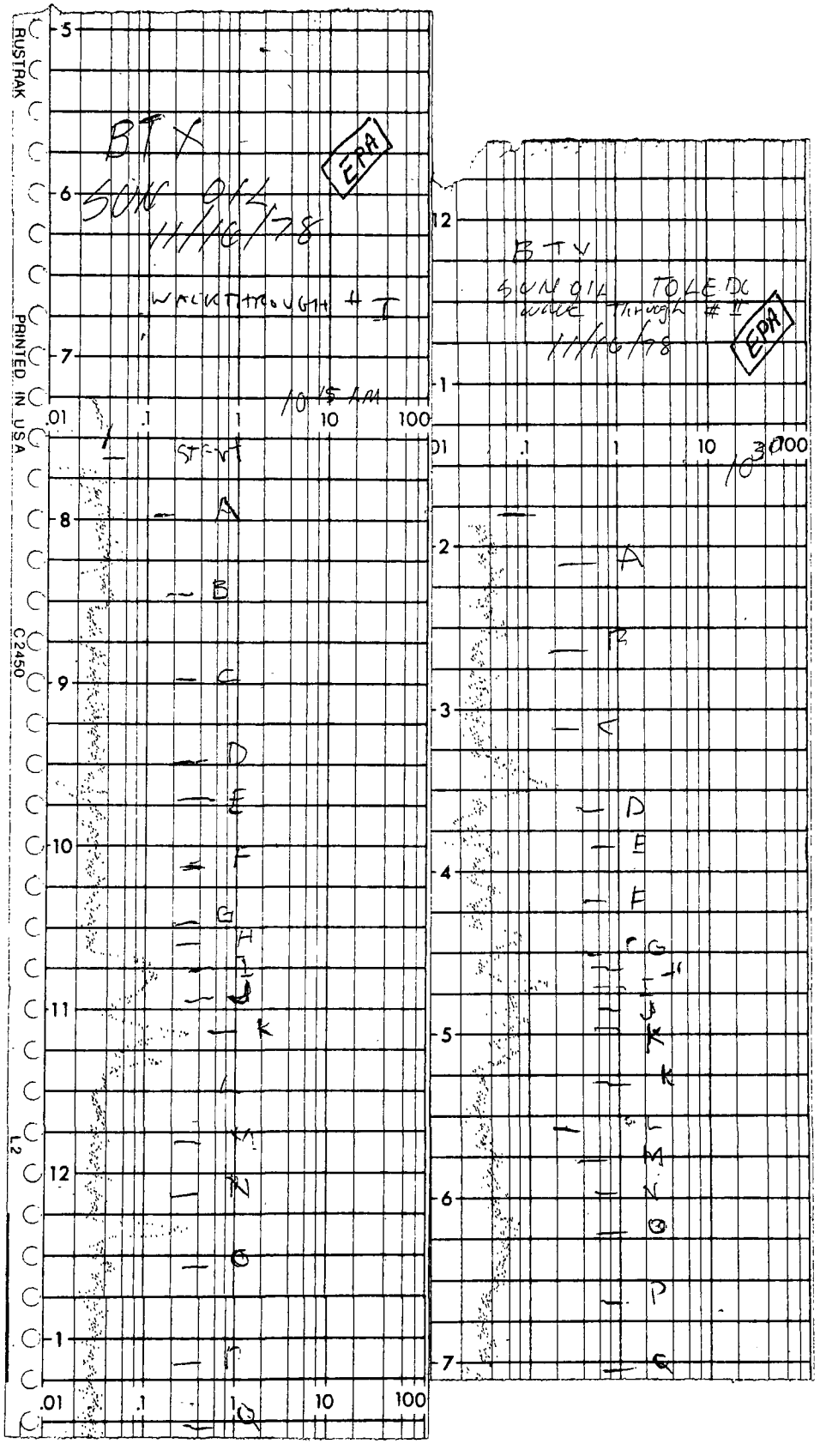
PROCESS GASOLINE BLENDING COMPONENTS

PAGE 2 OF 2	A	B
RECORDER	KC14	
INST. OPERATOR	WEK	
DATE	11-15-78	
INSTRUMENT	OVA-108	

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES	OPEN-ENDED LINE		OTHER
A	B	A	B	A	B			B	
EPA (DUR) 218 S-77-000-411 VAPOR SAMPLE STABALIZER BOTTOMS HEAVY REFORMATE				1430		S-77-000-435 Liquid ambient 70 sample 400			

SUN OIL TOLEDO REFINERY
11-16-78
UNIT 9-4 BTX
UNIT WALKTHROUGH

1/2

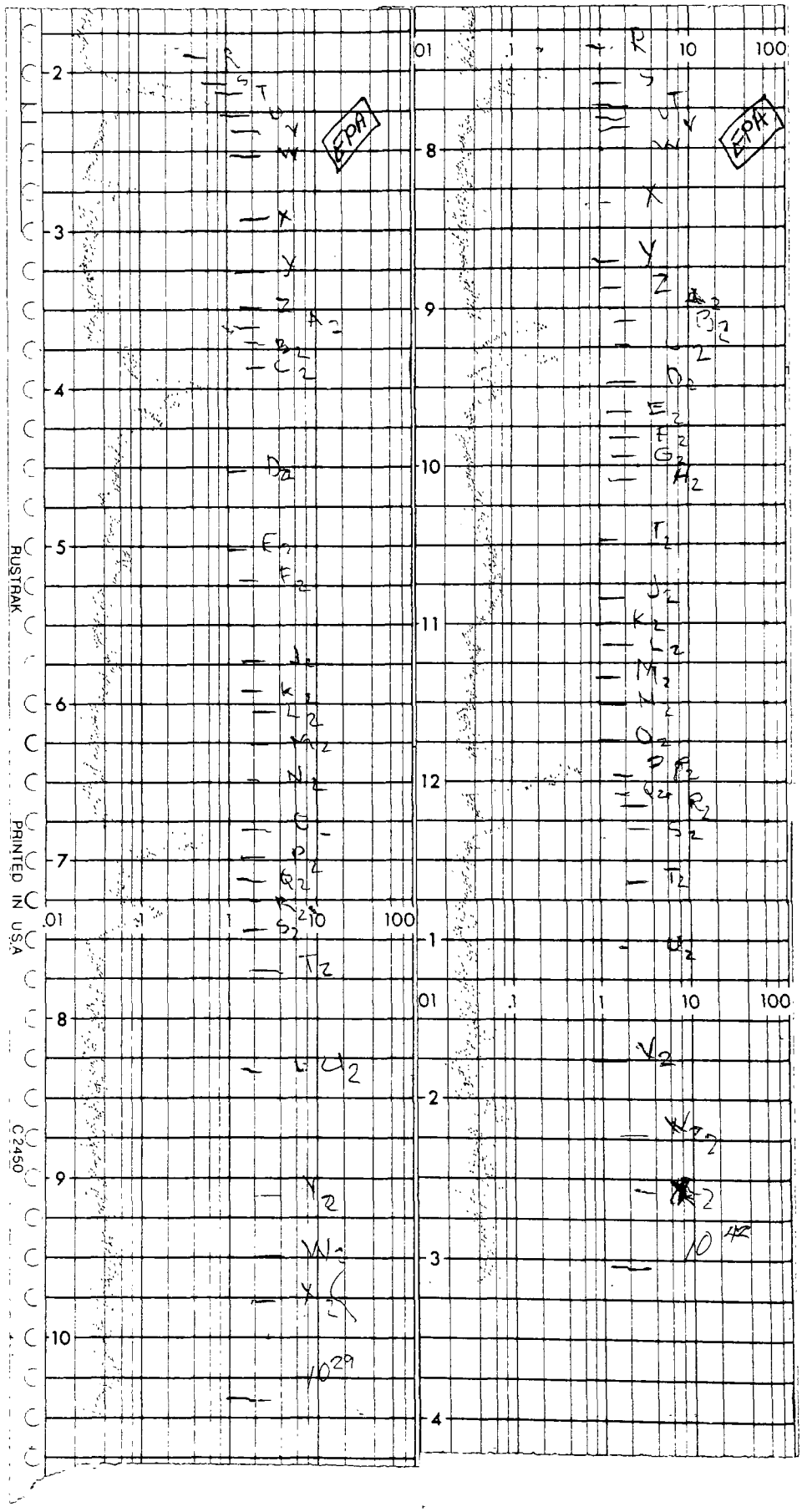


SUN OIL TOLEDO
11-16-78
UNIT 9-4 BTX
UNIT WALKTHROUGH

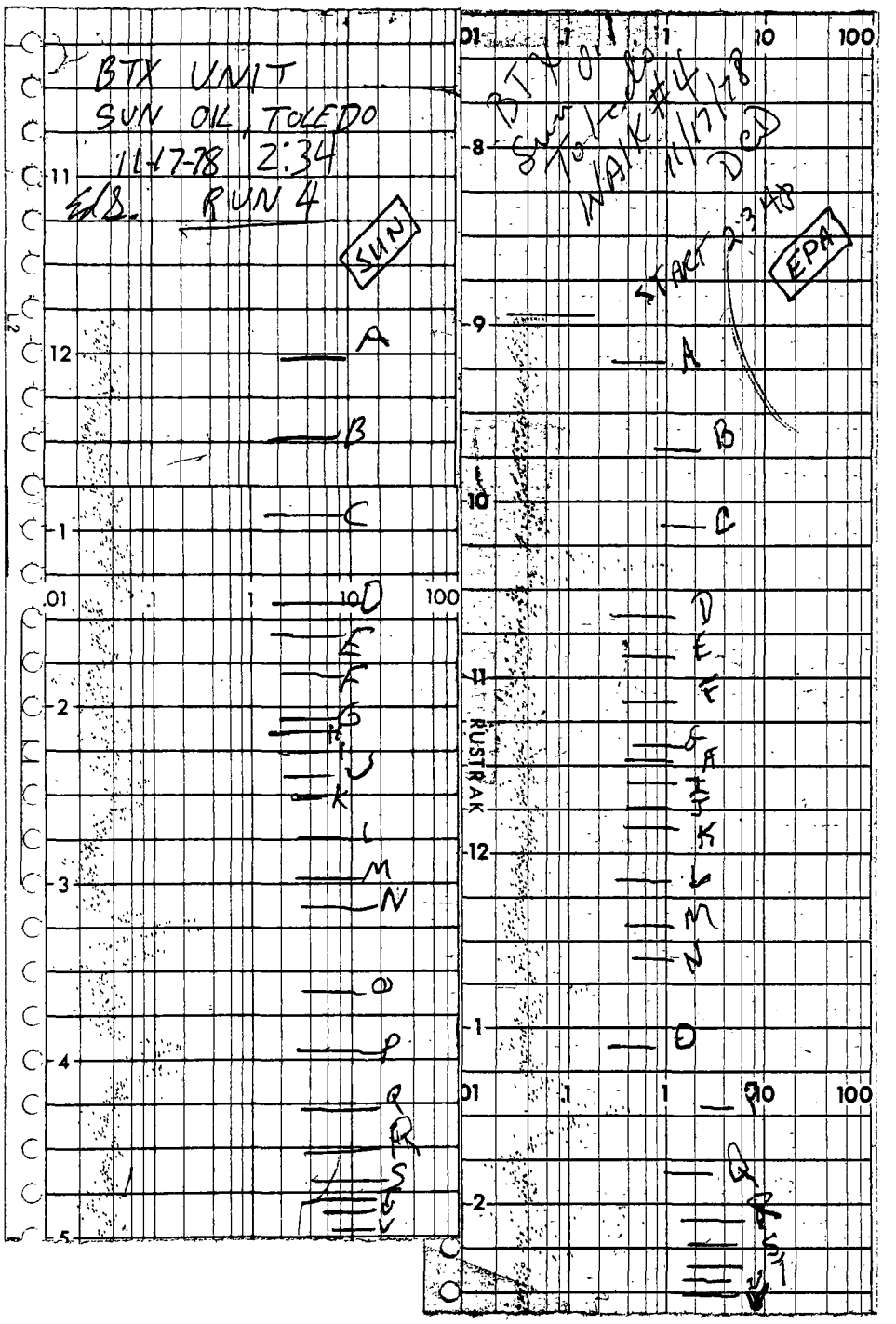
212

#1

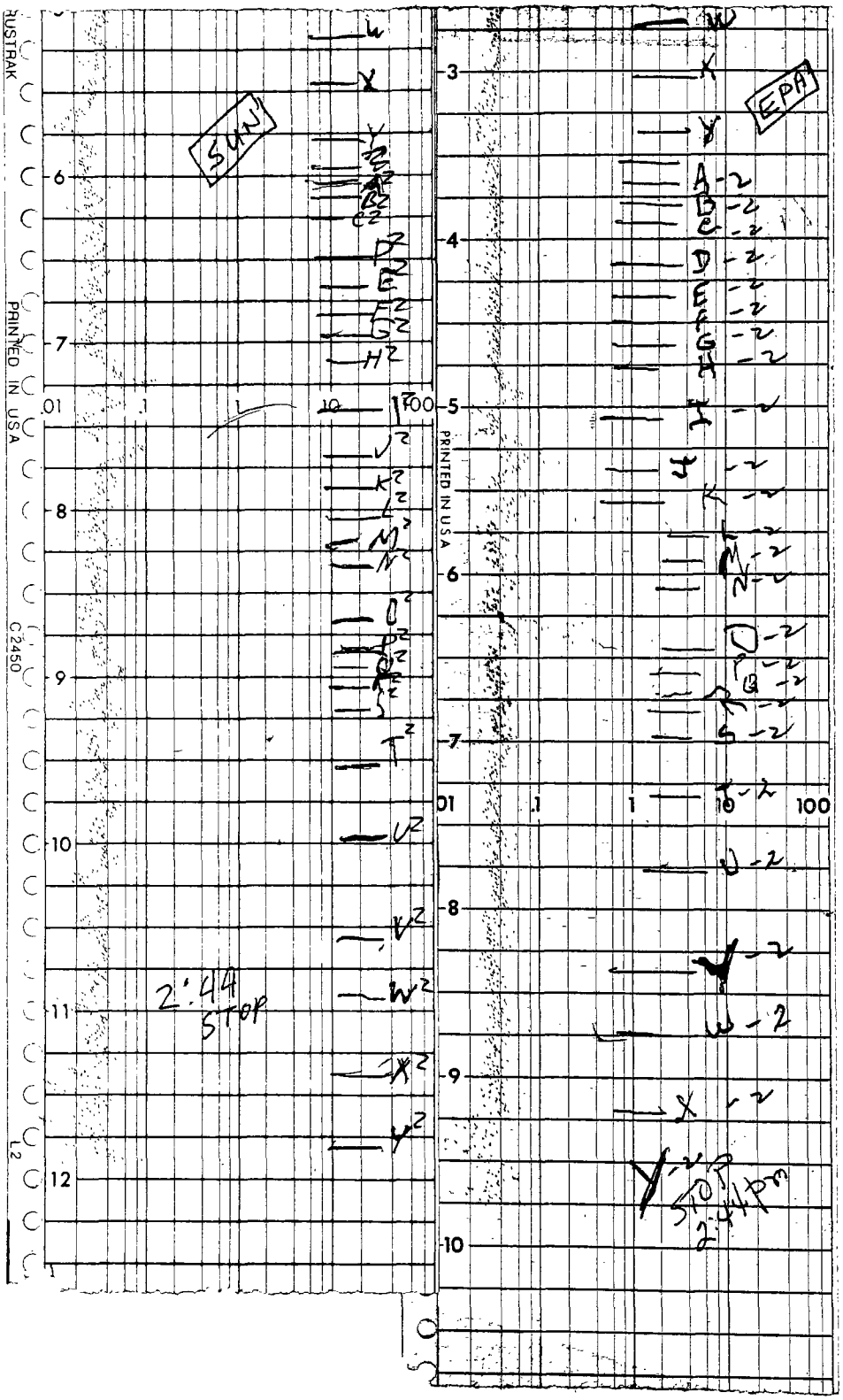
#2



SUN TOLEDO
9-4 BTX UNIT
WALKTHROUGH #4
11-17-78
1 of 2



SUN TOLEDO
9-4 BTK UNIT
WALKTHROUGH #
11-17-78
1 of 2



GRID NO. 9-4

FACILITY SUN OIL TOLEDO

PROCESS BTX UNIT MONITOR SYSTEM

PAGE OF	A	B
RECORDER	KCH	
INST. OPERATOR	WEK	
DATE	11-17-78	
INSTRUMENT		

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			DRAIN		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
BTX MONITOR SAMPLE POINT						VACUUM TEST					
		STREAM				FLOW READING (SCFH) WITH SAMPLE OPENING PLUGGED					
		1				1/2					
		2				1					
		3				1/2					
		4				0					
		5				0					
		6				0					
		7				0					
		8				0					
		9				0					
		10				0					
		11				0					
		12				2 1/2 — ROTOMETER MAY BE MALFUNCTIONING					
		13				0					
		NORMAL OPERATION				1-5 SCFH					

GRID NO. _____

FACILITY SUN OIL TOLEDO

PROCESS GASOLINE BLENDING COMPONENTS

PAGE 1 OF 1	A	B
RECORDER	KCH	
INST. OPERATOR	HD	
DATE	11-17-78	
INSTRUMENT	OVA 108	

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			DRAIN		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	S-77-000-417 VAPOR SAMPLE				time: 1003			AMBIENT 20 SAMPLE 1000			
	REFORMATE PLT. 6-3			T6301	BOTTOMS						
				S-77-000-427	liquid			PUMP INLET VALVE LEAK			
	S-77-000-418 EPA (DUR) 215 VAPOR SAMPLE				time: 1042		S-77-000-428 liquid				
	HYDROCRACKED GASO PLT 9-2				C5-C6 P-9257B MAIN FRACTIONATOR DRUM			AMBIENT 17 SAMPLE 710,000			
								PUMP OUTLET VALVE LEAK			
	S-77-000-420 EPA (DUR) 215 VAPOR SAMPLE				time: 1048			AMBIENT 9 SAMPLE 3000			
	RAFFINATE PLT 9-4				PCV 007 inlet valve		S-77-000-430 liquid				
	S-77-000-419 EPA (DUR) 215 VAPOR SAMPLE				time: 1059			AMBIENT 12 SAMPLE 300			
	HVY AROMATICS PLT 9-4				PRODUCT MOTOR VALVE LEAK		S-77-000-429 liquid				

GRID NO. ____

FACILITY Sun Oil - Toledo

PROCESS BTX fractionation

Area monitor system checks with Calibration Gases.

PAGE 1 OF 1	A	B
RECORDER	~~LE~~ KCH	
INST. OPERATOR	—	
DATE	11/17/78	
INSTRUMENT	—	

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	DRAIN A	DRAIN B	OTHER
START AROUND 3:15 PURGING LINE						9					
ON POINT 6											
ALREADY PURGING TO INST.											
CHANGE TO 7 3:22											
SUN MONITOR CALIB. GAS											
S-77-000-424 VAPOR SAMPLE EPA (DUR) 215 SUN MONITOR #2											
S-77-000-423 VAPOR SAMPLE EPA (DUR) 215 #9											
PURGE STARTED BETWEEN 11 & 12											
SAMPLED #2											
READINGS		BZ		TOL	XYL						
	1512	PT 2	0.04	18.16	21.29						
	1527	PT 9	0.00	44.39	19.40						

cylinder standard Eng. Science Analysis
Benz.
tol
p xylene
o xylene

Standard Cylinder Vendor analysis (mol%)
Benz. 5.37
tol 54.3
o xylene 28.1
p xylene 22.0

PURGE TIME
#2 ≈ 7-9 min
#9 ≈ 15 min

11 IN INSTRUMENT

Standard cylinder tag values: requested
Benzene 3 ppm
Toluene 50 ppm
p xylene 25 ppm
o xylene 25 ppm in air

GRID NO. —

FACILITY Sun Oil Company / Toledo

PROCESS — — — — — — —

Listing of Sample Numbers used

PAGE 1 OF 2	A	B
RECORDER	WEK	
INST. OPERATOR	—	
DATE	11/17/78	
INSTRUMENT	—	

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			DRAIN		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
577000	401	vapor	Compressor Bldg	Outlet valve leak							
	402	~~vapor~~ vapor	Pump 9412 B seal leak								
	403	vapor	Unnumber Control Valve			Bypass	Valve leak				
	404	liquid	Sample from unnumbered			Control	Valve (vapor - 403)				
	405	liquid	from pump 9412 B (vapor - 402)								
	406	vapor	Ambient air sample near pump 6325								
	407	vapor	#1 Debut. Bottoms Plt 4-1 - valve leak								
	408	vapor	#1A Debut Bottoms Plt 4-1 - valve leak								
	409	vapor	#2 Debut Bottoms Plt 4-1 - valve leak								
	410	vapor	Merox Product - valve leak								
	411	vapor	Stabalizer Btms / Heavy Reformate - valve leak								
	412	vapor	Unit Feed Preheat -								
	413	vapor	ambient at Area Monitor #8								
	414	liquid	Unit Feed								
	415	vapor	East Wastewater Separator Outfall (11/16)								
	416	vapor	East Wastewater Forebay (11/16)								
	417	vapor	Reformate Plt 6-3 T6301 Bottoms - Pump inlet valve leak								
	418	vapor	Hydrocracked Gasoline Plt 9-2 P9257B Main Fract. Drum - Pump outlet valve leak								
	419	vapor	HF4 Aromatics Plt 9-4 - Product Motor valve leak								
	420	vapor	Raffinate Plt 9-4 - PCV 007 inlet valve leak								
	421	vapor	Wastewater Separator Forebay (11/17)								
	422	vapor	Wastewater Separator Outfall (11/17)								
	423	vapor (Bag sample)	Sun Cylinder Calibration Gas Used for test @ AM Rf. 9								
	424	vapor (Bag sample)	"	"		"	"	"	"		AM Rf. 2

GRID NO. _____

FACILITY Sun Oil Co. Toledo

PROCESS _____

Listing of Sample Numbers Used

PAGE 2 OF 2	A	B
RECORDER	WER	
INST. OPERATOR	—	
DATE	11/17/78	
INSTRUMENT	—	

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			DRAIN		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
577 000	425	liquid	East Wastewater	Separator	Forebay						
	426	liquid	East Wastewater	Separator	Outfall						
	427	liquid	Reformate Plt 6-3					(6301 Bottoms)			
	428	liquid	Hydrocracked Gasoline Plt 9-2					(9-2 Hydrocracker Gasoline)			
	429	liquid	Heavy Aromatics Plt 9-4					(9-4 Xylene Tower Bottoms)			
	430	liquid	Raffinate Plt 9-4					(Plt 9-4 Udex Raffenate)			
	431	liquid	#1 Debut. Bottoms					(#1 Debut Btms)			
	432	liquid	#1A Debut. Bottoms					(#1A Debut Btms)			
	433	liquid	#2 Debutanizer Bottoms					(#2 Debut)			
	434	liquid	Merox Product					(Merox Prod)			
	435	liquid	Stabalizer Bottoms - Heavy Reformate					(6-1 Stabelizer Bottoms)			

GRID NO. 9.4

FACILITY PETROLEUM REFINERY - Sun Oil Toledo

PROCESS BTX UNIT - 2ND LEVEL

PAGE / OF 5	A	B
RECORDER	LEC	LEC
INST. OPERATOR	ES	DD
DATE	1-16-78	1-16-78
INSTRUMENT	OVA-1410	OVA-1691

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
Xyl-OVHD Accumulator		KT-2					450	400			
		V-94-17		1/NC	1/NC		9/NC	9/NC			
							150	200			
							5/NC	5/NC			
~~Xylene Tower~~		~~OVHD cond.~~					~~3/NC~~				
Line from Xyl cond Tower							1/NC	1/NC			
							30	30			
Benzene OVHD		Accumulator					9/NC	9/NC			
		V-94-14		1/NC	1/NC		7/NC	7/NC			
Toluene OVHD		Accumulator				(X)	1500	2500			
		V-94-16					~~3000~~	5000			
							~~200~~				
				2ND Level			150	200			
							400	400			
							5/NC	5/NC			
							70	70			
				1ST Level			300	NC			
							2000	2000			
							5000	5000			
							7/NC	7/NC			

(X) (O) Steady Leak, dripping from Valve

GRID NO. 9-4

FACILITY PETROLEUM REFINERY Toledo Sun Oil

PROCESS BTX - 240 LEVEL

PAGE 2 OF 5	A	B
RECORDER	LEC	LEC
INST. OPERATOR	ES	DD
DATE	11-16-78	11-16-78
INSTRUMENT	OVA 1410	OVA-1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
CLAY TOWER		SKID DRUM V-94-11			2ND Level		300	500			
							200	600			
							NC	NC			
							~~NC~~ 150	~~NC~~ 100			
							T/NC	T/NC			
					1st Level		150	150			
							10/NC	10/NC			
~~CLAY TOWER~~		V-94-13B									
Benzene Frac. Tower Reflux		SKID TANK V-94-27					1 OFF SCALE	OFF SCALE 1000			1ppm
							10	50			
							10/NC	10/NC			
	PIT						2 NC	2 NC			

GRID NO. 9-4

FACILITY PETROLEUM REFINERY - SUN OIL TOLEDO

PROCESS BTX 2ND LEVEL

PAGE 3 OF 5	A	B
RECORDER	LEC	LEC
INST. OPERATOR	ES	DD
DATE	11-16-78	11-16-78
INSTRUMENT	OVA 1410	OVA 1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
Benz Knockout TANK V-94-16							150 50 16/NC	150 50 16/NC			
RAFFINATE WASH TOWER T-94-04							11/NC 4/NC	11/NC 4/NC			
EXTRACTOR TOWER T-94-01							11/NC	11/NC			
SOLVENT STRIPPER + FLASH DRUM T-94-02							11/NC	11/NC			
WATER EXCHANGER E-94-02B		FV-005 control valve		800 4000 2	2000 2500		2/NC	2/NC			
							100 8/NC	30 8/NC			
WATER EXCHANGER E-94-02A		(CONT. VALVE FV-004)		250	100		3/NC 8/NC	30 2 NC 8/NC			

GRID NO. 9-4

FACILITY Petroleum Refinery Toledo - Sunoil

PROCESS BTX

PAGE 4 OF 5	A	B
RECORDER	LEC	LEC
INST. OPERATOR	ES	DD
DATE	11-16-78	11-16-78
INSTRUMENT	OVA-1410	OVA-1691

25 (31)

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
VENT CONDENSER							400	400			
E 94-25		PV 012B →		NC	50		150	100			
		PV 035B →		> 10,000	OFF SCALE		~~400~~	~~50~~			
		PV 016B →		70	50		900	500			
		PV 043B →		> 10,000	> 10,000		400	200			
							30	50			
							NC	80			
							30	50			
							NC	50			
							1500	100			
							16/NC	16/NC			
							NC	30			
		PV 004B		NC	NC		30	20			
		PV-005B		NC	NC		45	70			
		PV 006B		NC	NC		175	50			
		PV 007B		3000	1100		100	40			
							1500	2000			
							100	100			
							24/NC	24/NC			
STRIPPER Overhead Accumulator							17/NC	17/NC			
V-94-02				20	15						
		PV-0037		NC	NC						
							6/NC	6/NC			

GRID NO. 9-4

FACILITY Sun Oil - Toledo

PROCESS BTX

PAGE 5 OF 5	A	B
RECORDER	LEC	LEC
INST. OPERATOR	ES	DP
DATE	11-16-78	11/16/78
INSTRUMENT	OVA-1410	OVA-1691

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			OPEN-ENDED LINE		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
Stripper Overhead Accumulator V-94-03							14/NC 13/NC	14/NC			
Toluene Tower T-94-07							13/NC	13/NC			
Toluene Exchanger							250 9/NC	300 9/NC			
Toluene Exchanger							10/NC	10/NC			
Benzene Tower T-94-06							11/NC	11/NC			
Flare Knock Out V-94-29							8/NC	8/NC			

GRID NO. 94

FACILITY Sun Oil - Toledo

PROCESS BTX Fractionation

Resurvey of all equipment with C @ source >10000ppm. Special OVA probe assemblies used.

PAGE 1 OF 3	A	B
RECORDER	WEK	
INST. OPERATOR	HB	
DATE	11/14/78	
INSTRUMENT	OVA 1400	

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
				Dilution tips: BLACK - 7.7:1		(5000ppm → 650 ppm)					
				GREEN - 13. :1		(5000 ppm → 350 ppm)					
				BLUE - 20:1		(5000 ppm → 250 ppm)					
① FV001 CV outlet block valve (steam stem packing gland leak)											
no dilution @ source				: >10000							
1 cm				: 4500		(highest, range = 1000 - ~~5000~~ 4500)					
5 cm				: 500		(highest, range = 100 - 500)					
7.7:1 dilution @ source				: >10000							
20:1 dilution @ source				: 1800		(act. conc = 1800 x 20 = 36000 ppm)					
② Pump 9404B outlet block valve											
no dilution @ source				: >10000							
1 cm				: 6000		(highest, range nearly 1000 - 6000)					
5 cm				: 300		range 100 - 300)					
7.7:1 dilution @ source				: 3500		(act conc = 3500 x 7.7 = 26,950 ppm)					
③ Unnumbered CV next to LV021 or bypass block valve											
no dilution @ source				: >10000							
1 cm				: 5000							
5 cm				: 320							
7.7:1 dilution				: 4000		(act. conc. = 4000 x 7.7 = 30,800 ppm)					

GRID NO. 94

FACILITY Sun Oil, Toledo

PROCESS BTX fractionation

PAGE 2 OF 3	A	B
RECORDER	WK	
INST. OPERATOR	HB	
DATE	11/16/78	
INSTRUMENT	OVA 1400	

	PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
(4)	Pump	9414A	on seal (		guard screen		prevents getting dilution			probe tip at interface.		
		at source : 2000	not immediately adjacent -- not sampled									
(5)	CV	LV023	bypass block valve									
	at source :		>10000									
	1 cm :		>10000									
	5 cm :		320									
	7.7:1 dilution :		6000	(act. conc. = 6000 x 7.7 = 46,200 ppm)								
(6)	PV 026A		top side tap valve									
	at source :		7000									
	1 cm :		1500									
	5 cm :		120									
(7)	~~Bo~~ Between clay treaters :		small valve on drain for blinded line from pipe rack area (near heat treater)									
	at source :		>10000									
	1 cm :		2000									
	5 cm :		220									
	7.7:1 dilution :		~~9000~~ 9000	(act. conc. = 9000 x 7.7 = 59,400 ppm)								

GRID NO. 94

FACILITY Sun Oil Toledo

PROCESS BTX Fractionation

Special probe testing at leaks

PAGE 3 OF 3	A	B
RECORDER	WK	
INST. OPERATOR	HB	
DATE	11/14/78	
INSTRUMENT	OVA 1400	

	PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
(8)	(Pump 943 B)		(near pump)		2" enclosed flow		control valve. (top bypass)					
	@ source :		>10000									
	1 cm :		4500									
	5 cm :		200									
	7.7:1 dilution :		2500	(act conc. = 2500 x 7.7 = 19,250 ppm)								
(9)	Pump 942S A		Bypass block valve – up too high could not reach.									
(10)	CV PV 043B		stem seal									
	at source		: >10000									
	1 cm		: >10000									
	5 cm		: 500									
	7.7 : 1 dilution :		7000	(act conc = 7000 x 7.7 = 53,900 ppm)								
(11)	CV PV 035B		stem seal									
	@ source		: >10000									
	1 cm		: 8500									
	5 cm		: 1000									
	7.7:1 dilution		1700	(act. conc. = 1700 x 7.7 = 13,090 ppm)								

GRID NO. 9-4

FACILITY SUN OIL TOLEDO

PROCESS BTX

PAGE 1 OF	A	B
RECORDER	KCH	
INST. OPERATOR	DD	
DATE	11-16-78	
INSTRUMENT	OVA-108 169	

PUMP SEAL A	PUMP SEAL B	COMP. SEAL A	COMP. SEAL B	CONTROL VALVE A	CONTROL VALVE B	VALVES TYPE	VALVES A	VALVES B	OPEN-ENDED LINE A	OPEN-ENDED LINE B	OTHER
S-77-000-412 VAPOR SAMPLE				UNIT FEED PREHEAT					BACKGROUND ≈ 70 ppm		
0928 LIQUID SAMPLE, TAKEN PURGE & SPILLAGE TO PAD									SAMPLE 710,000 ppm		
									S-77-000-414 LIQUID SAMPLE		
WIND FROM NORTH-NORTHEAST AT 5-8 MPH											
S-77-000-413 VAPOR EPA (DUR) 215 SAMPLE									BACKGROUND 10 ppm		
				AROMATICS SAMPLE POINT 8 North-NE					SAMPLE 22 ppm		
0942 AMBIENT				WIND FROM 10-15 MPH UPWIND PUMP MP 9A 10B BEING DRAINED TO ENCLOSED SEWER SYSTEM - THEN WATER FLUSHED TO PAD					Benzene Ambient Pump	VARIES FROM 10-40 ppm	

GRID NO. _____

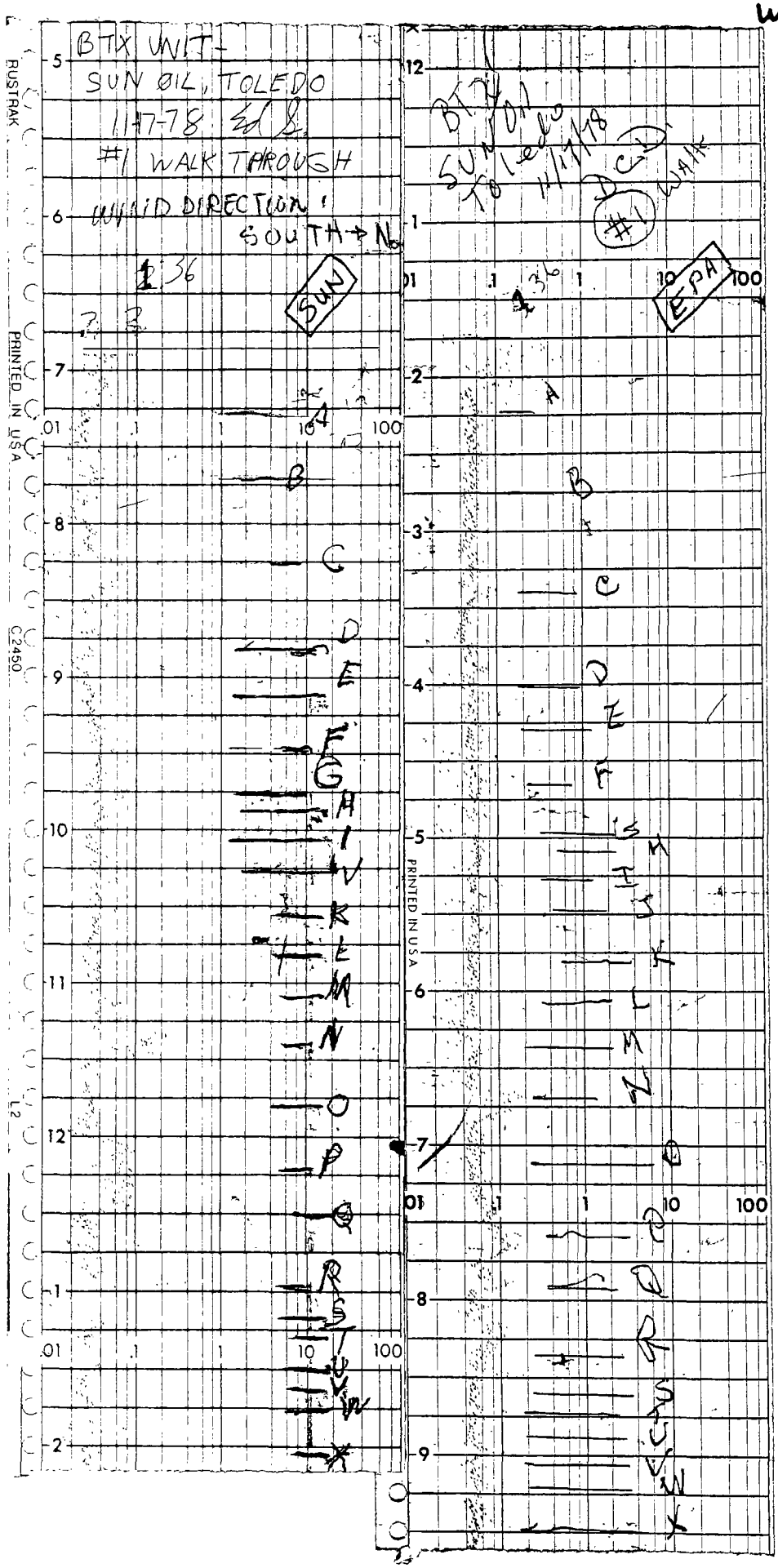
FACILITY SUN OIL / TOLEDO

PROCESS WASTEWATER SEPARATOR

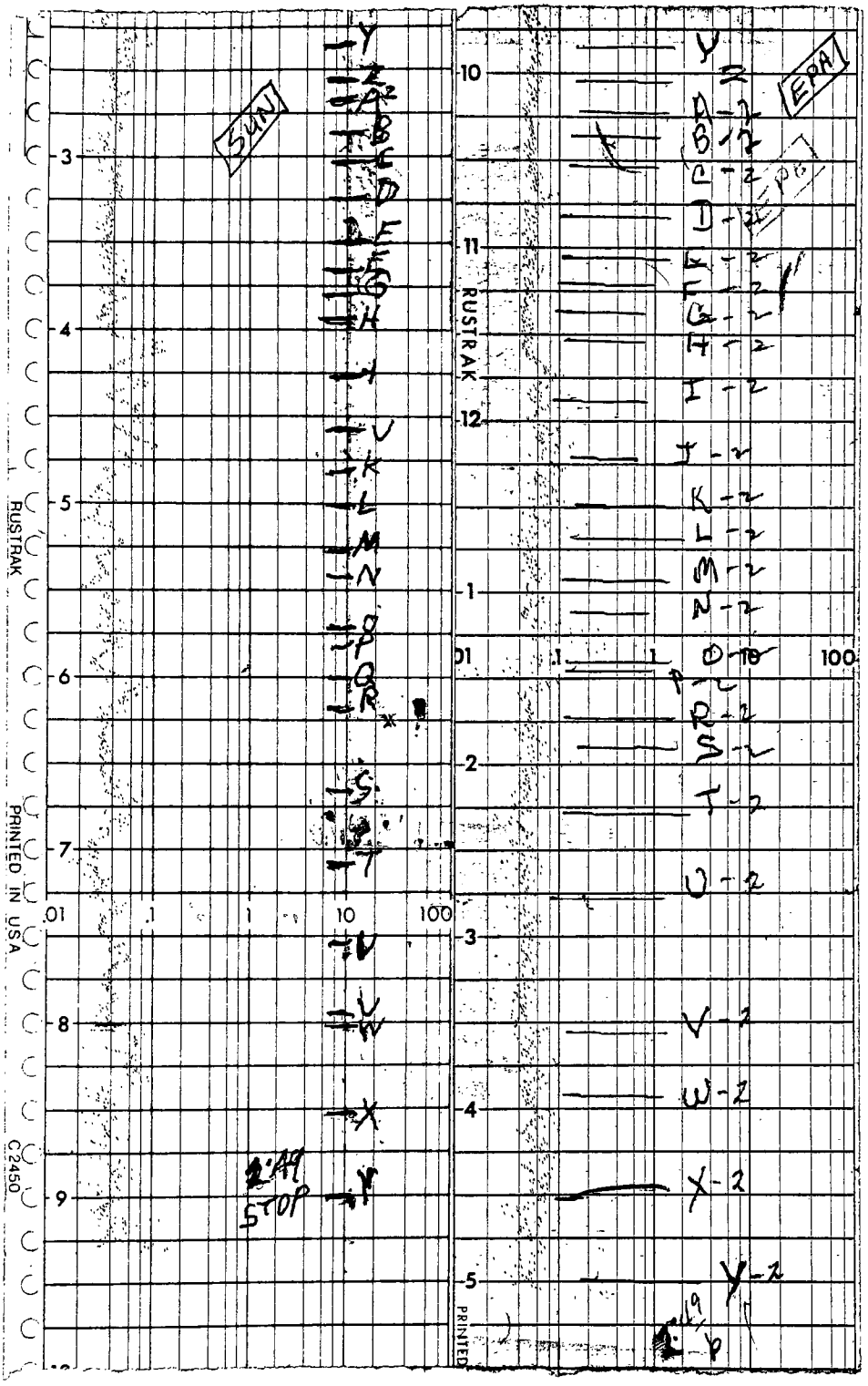
PAGE OF	A	B
RECORDER	KCH	
INST. OPERATOR	KCH	
DATE	11-16-78	
INSTRUMENT	STRIPPER ONLY	

PUMP SEAL		COMP. SEAL		CONTROL VALVE		VALVES			DRAIN		OTHER
A	B	A	B	A	B	TYPE	A	B	A	B	
	S-77-000-415 VAPOR EPA (DUR) 215 SAMPLE						11-16-78	1418			
EAST WASTEWATER SEPARATOR OUTFALL (END BAY)											
PROBABLY 50-2000 ppm Methyl some water vapor											
	S-77-000-416 vapor						11-16-78	1415			
EAST WASTEWATER SEP FOREBAY											
~1000-12000 ppm											

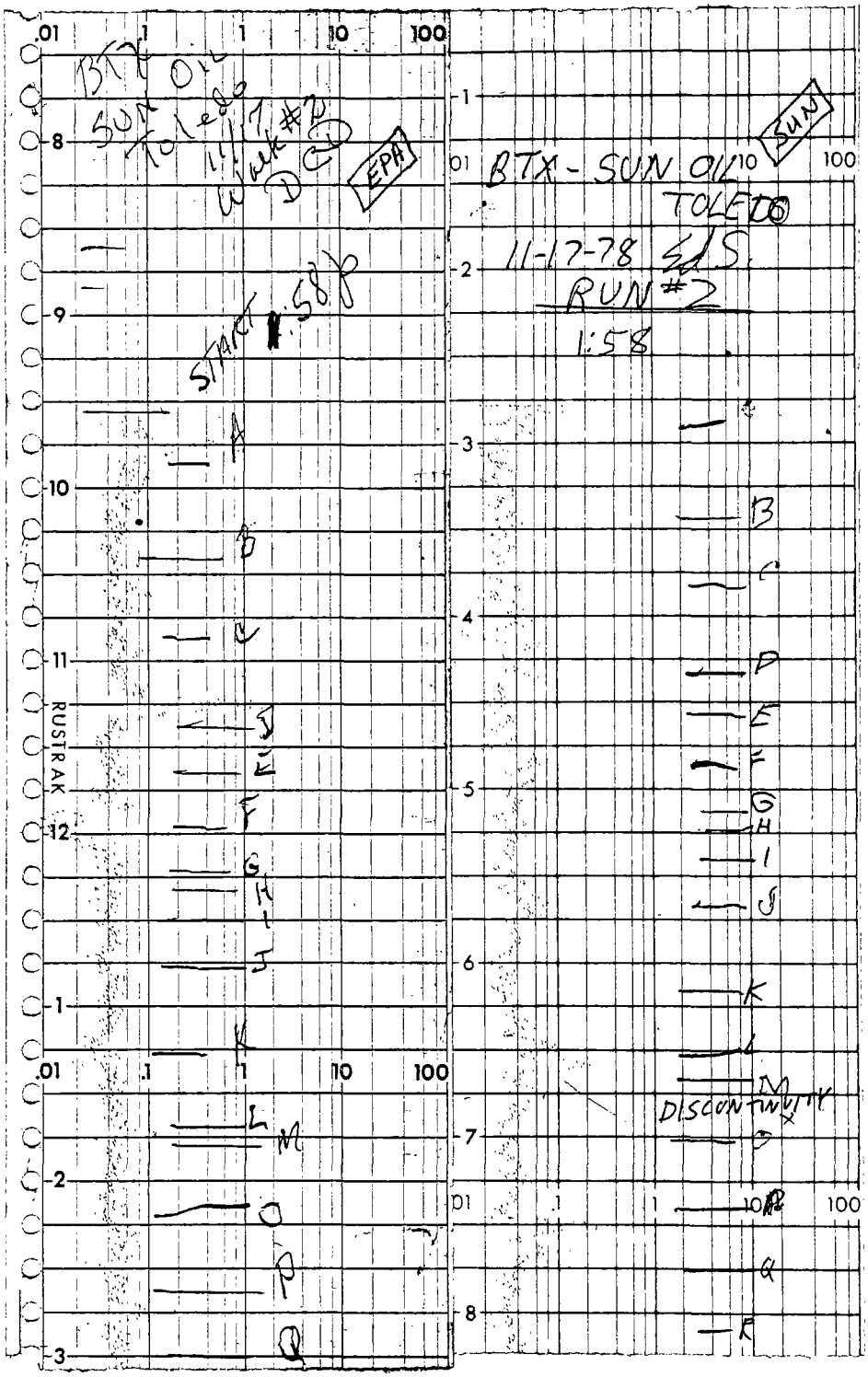
SUN TOLEDO
9-4 BTX UNIT
WALKTHROUGH #1
11-17-78
1 of 2



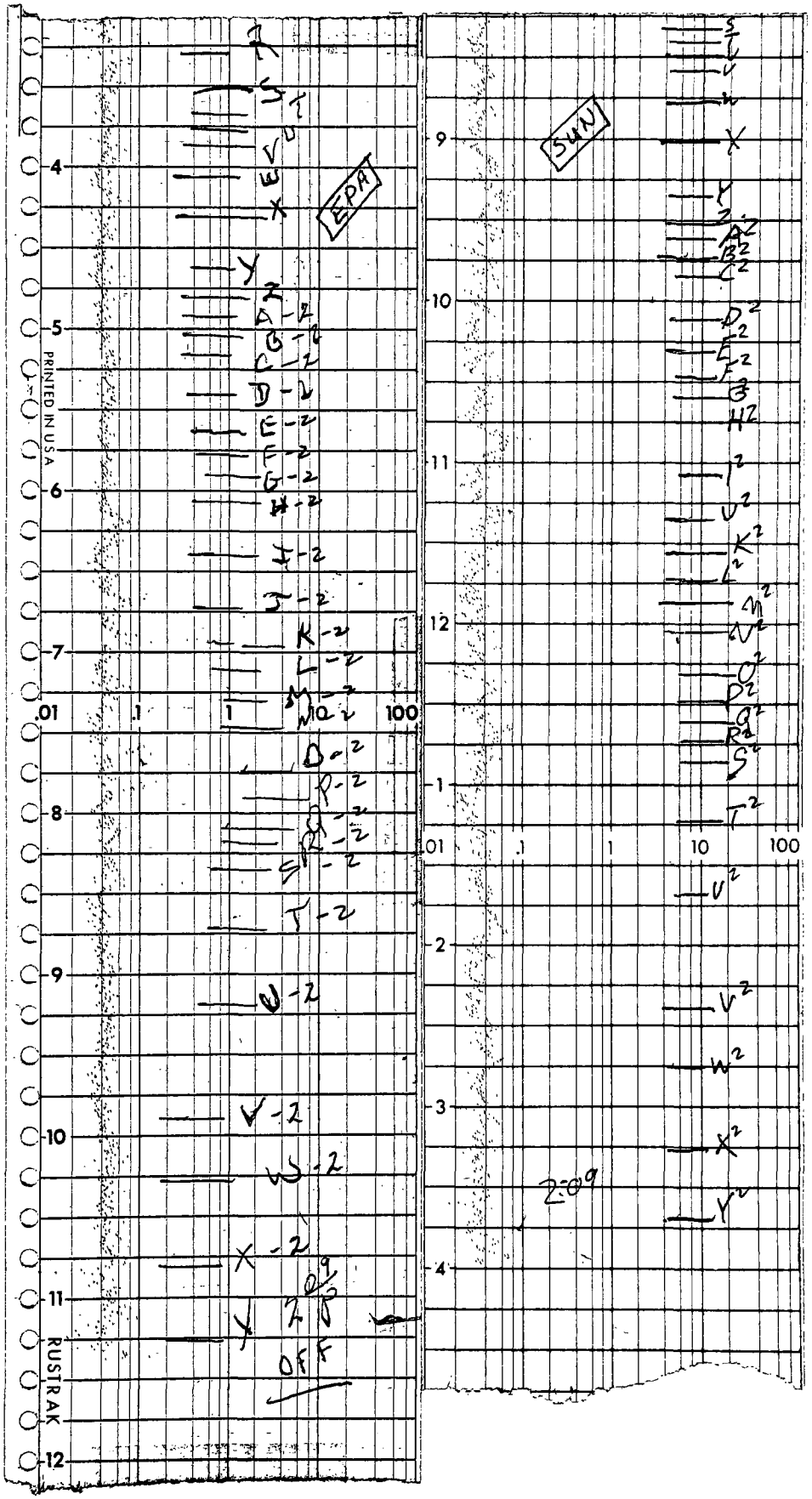
SUN TOLEDO
9-4 BTX UNIT
WALKTHROUGH #1
11-17-78
2 of 2



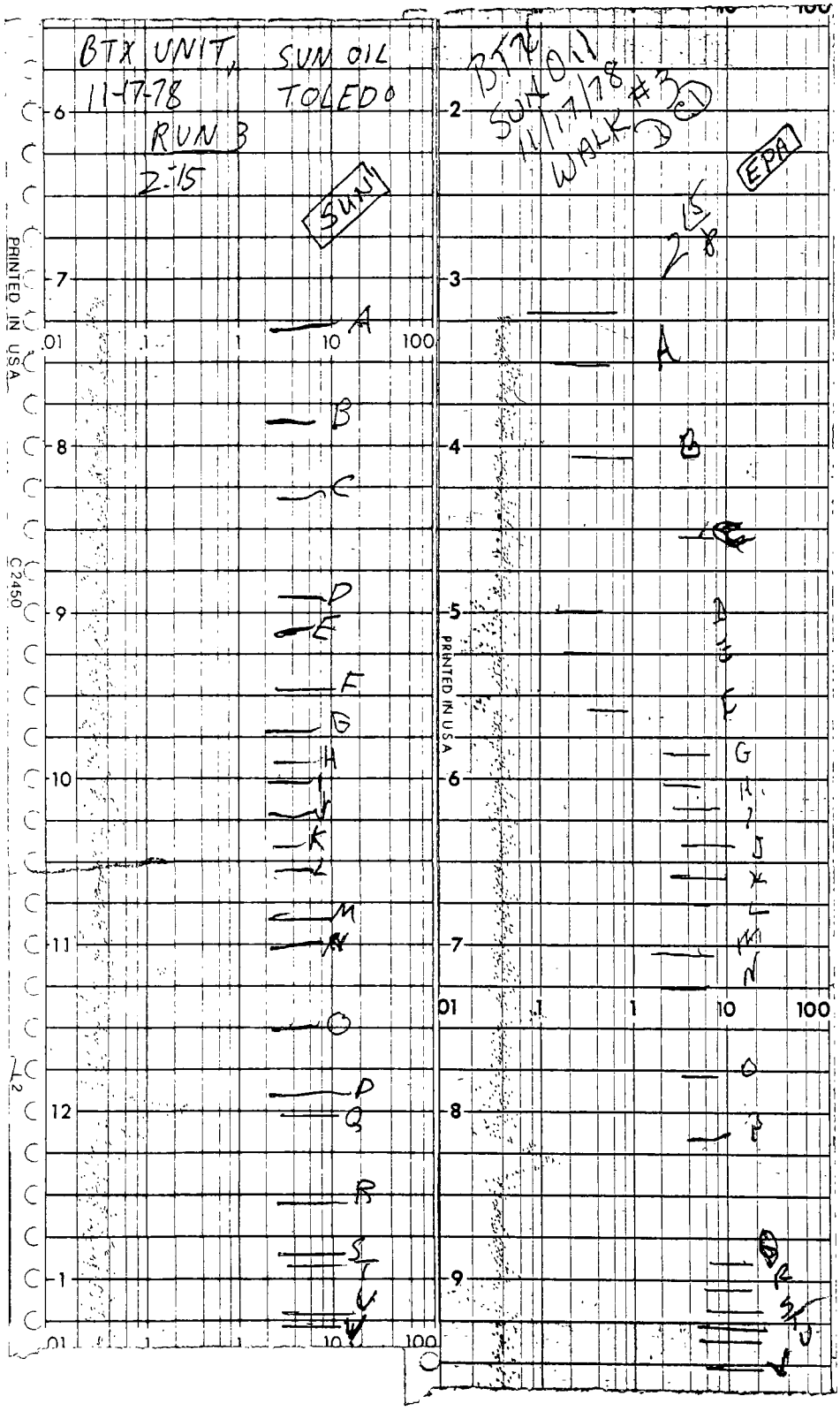
SUN TOLEDO
9-4 BTX UNIT
WALKTHROUGH #2
11-17-78
1 of 2



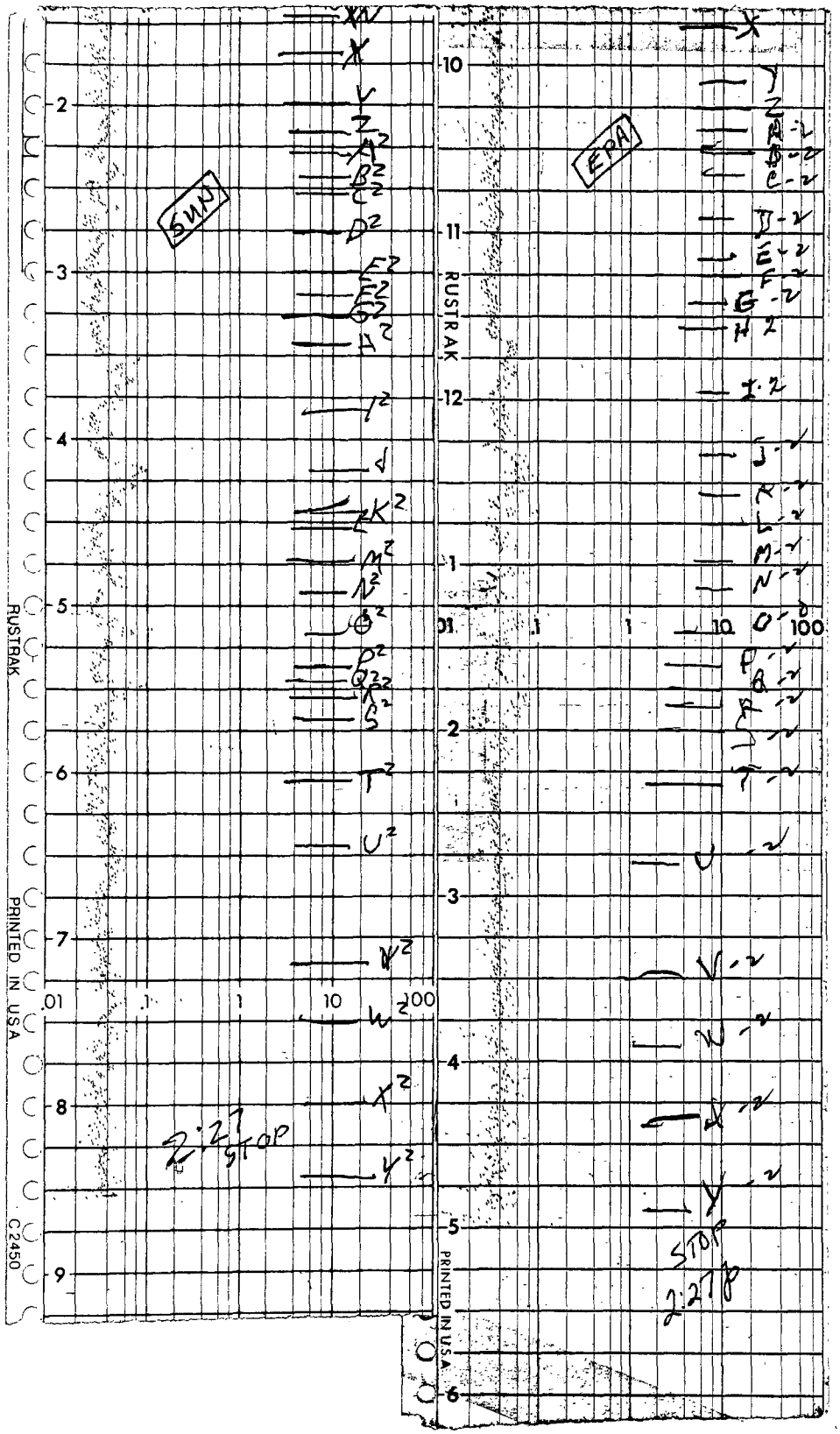
SUN TOLEDO
9-4 BTX UNIT
WALKTHROUGH #2
11-17-78
2 of 2



SUN TOLEDO
9-4 BTX UNIT
WALKTHROUGH #3
11-17-78
1 of 2



SUN TOLEDO
9-4 BTX UNIT
WALKTHROUGH #3
11-17-78
2 of 2



APPENDIX C

TEST LOG

TEST LOG

11/13/78 - HDA OVA (2 analyzers)

vapor sample 1632-1647 Fenceline (2 analyzers)

11/14/78 - 0950-1015 BTX walkthrough (1 analyzer)

0930-1100)
) BTX OVA (2 analyzers)
1335-1524)

1610-1625 Fenceline (2 analyzers)

vapor and liquid samples

11/15/78 - 0915-1045)
)
1300-) HDA OVA (2 analyzers)

1610-1629 HDA walkthrough (1 analyzer)

vapor and liquid samples

11/16/78 - 1015-1042 BTX walkthrough (1 analyzer)

BTX 2nd level (2 analyzers)

BTX Unit: Tests of equipment w/>10000 for distance from source and dilution probes.

vapor and liquid samples

11/17/78 - 1336-1444 BTX walkthrough (2 analyzers (4 runs))

BTX monitor system test

vapor and liquid samples

APPENDIX D

ARCAS VENDOR INFORMATION FOR THE FIXED MONITORING SYSTEM

ARCAS DIVISION
ANACON INC.
ANALYTICAL EQUIPMENT

PMC 2000 SYSTEM OVERVIEW

The ARCAS PMC2000 Computer System is a bus oriented computer system which has been built around the Motorola MC6800 microprocessor. The heart of the system is the MPU module which contains the eight-bit parallel microprocessor and the associated control circuitry. The MC6800 microprocessor has 16 address lines used to address up to 65,536 words of memory and may directly address peripheral control registers used for input/output (I/O) operations. The MPU has two eight-bit accumulators, an eight-bit condition code register, a sixteen-bit stack pointer register, a sixteen-bit index register, and an interrupt system which includes vector addressing for interrupts generated from restart/powerfail signals, software requests and requests from external peripheral devices. Because an interrupt mask bit is provided in the condition code register, interrupt nesting is permitted which provides for priority interrupts.

The MPU module communicates to the other components in the system over a bus or mother board. The mother board is constructed such that each board in the system may occupy any position or slot on the bus.

The System Software provided is a real time system with foreground/background capability. The foreground processor includes:

Chromatograph control logic
Peripheral interrupt handlers
Analog input handlers
Alarm control logic
Chromatograph calibration routines
Analog output handlers

The background processor includes:

List Option - which lists the options available in the background processor.
Prog Display Option - which displays the function number and values required by the chromatograph.
Reports Option - which is used to obtain the latest analysis report and shift report.
Peak Name Option - which allows the user to input or modify peak names up to a maximum of 10 peaks (5 characters per peak).
Time-Date Option - which allows the user to enter or modify the tim and date and up to three shift times.
Test Pack Option - which contains several system hardware tests.

ANALYZER

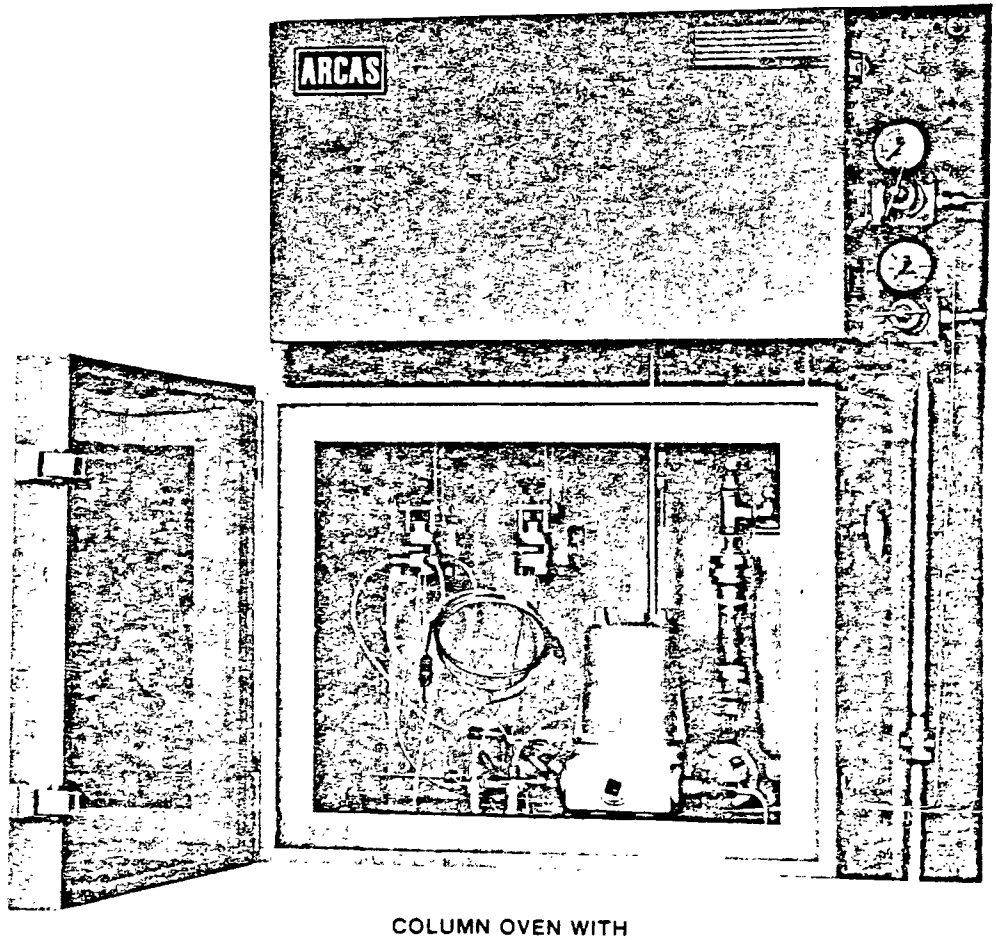
INTRODUCTION

These features are to be found in various models of the Analyzer sections of ARCAS process gas chromatographs:

- Double-walled ovens with inner layer of insulation; inside liner is stainless steel.
- Air bath temperature control system using venturi air eductors and low-mass electrical heaters.
- Solid-state proportional temperature controllers.

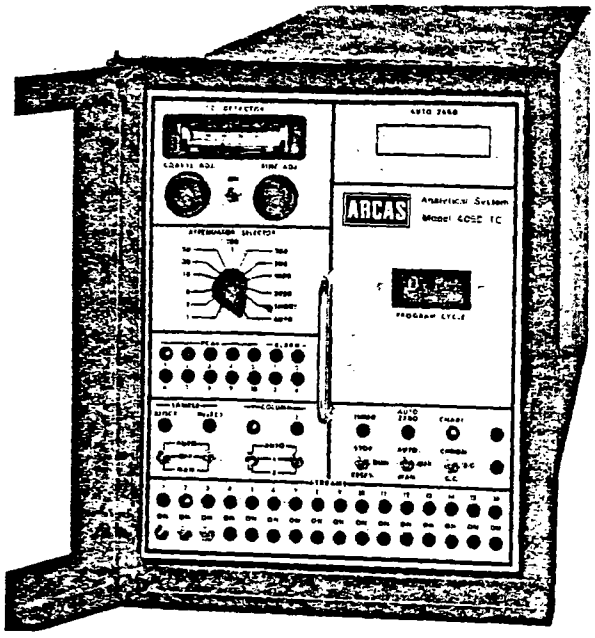
A description of the main components mounted within or alongside the oven together with some pertinent instructions are found in the following list. Detail sheets covering the appropriate types or models pertaining to your specific instrument are inserted immediately following this page.

Air Bath Temperature Control System
Carrier and Sample Flow
Sample and Column Switching Valves
Detector Wiring Diagram (TC Models)
Sample Valves — Brochure
Sample Valve Actuator Assembly
Sample Valve Flow Schematic
Solenoid Valves
CPI Tube Fitting (Instructions)
Case Purge Air Pressure Switch

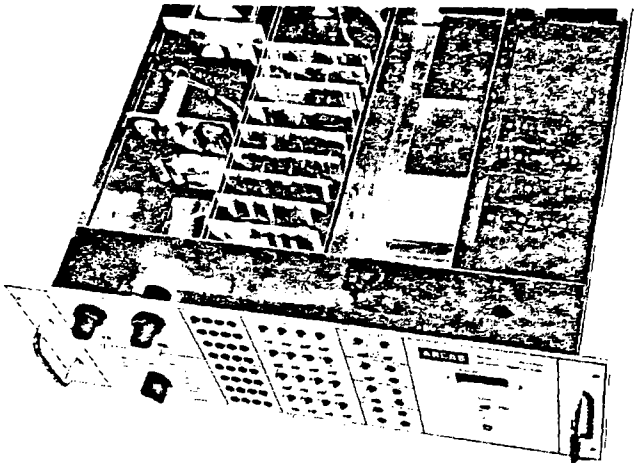


COLUMN OVEN WITH
F.I.D. DECTOR

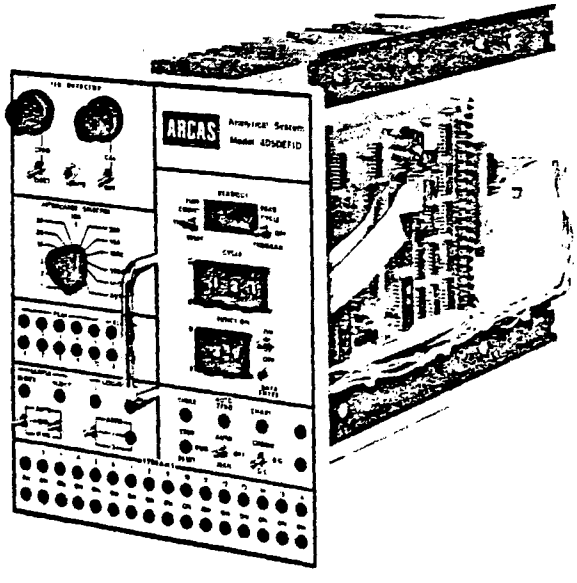
ARCAS PROCESS GAS CHROMATOGRAPH
PROGRAMMERS



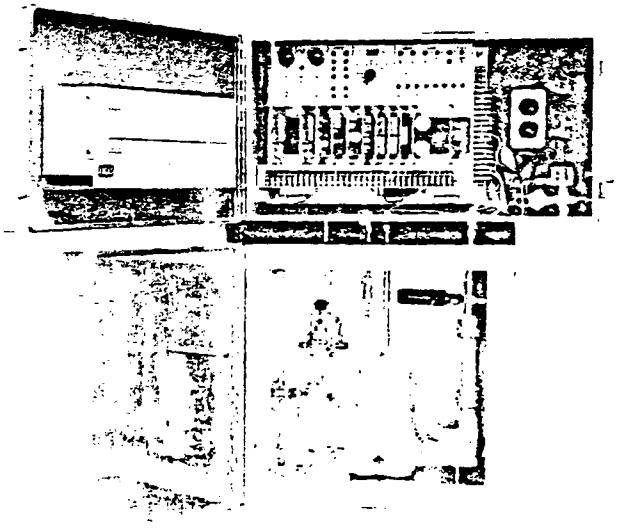
MODEL 405 — PANEL MOUNT
SWITCH MEMORY
DIGITAL TIMER



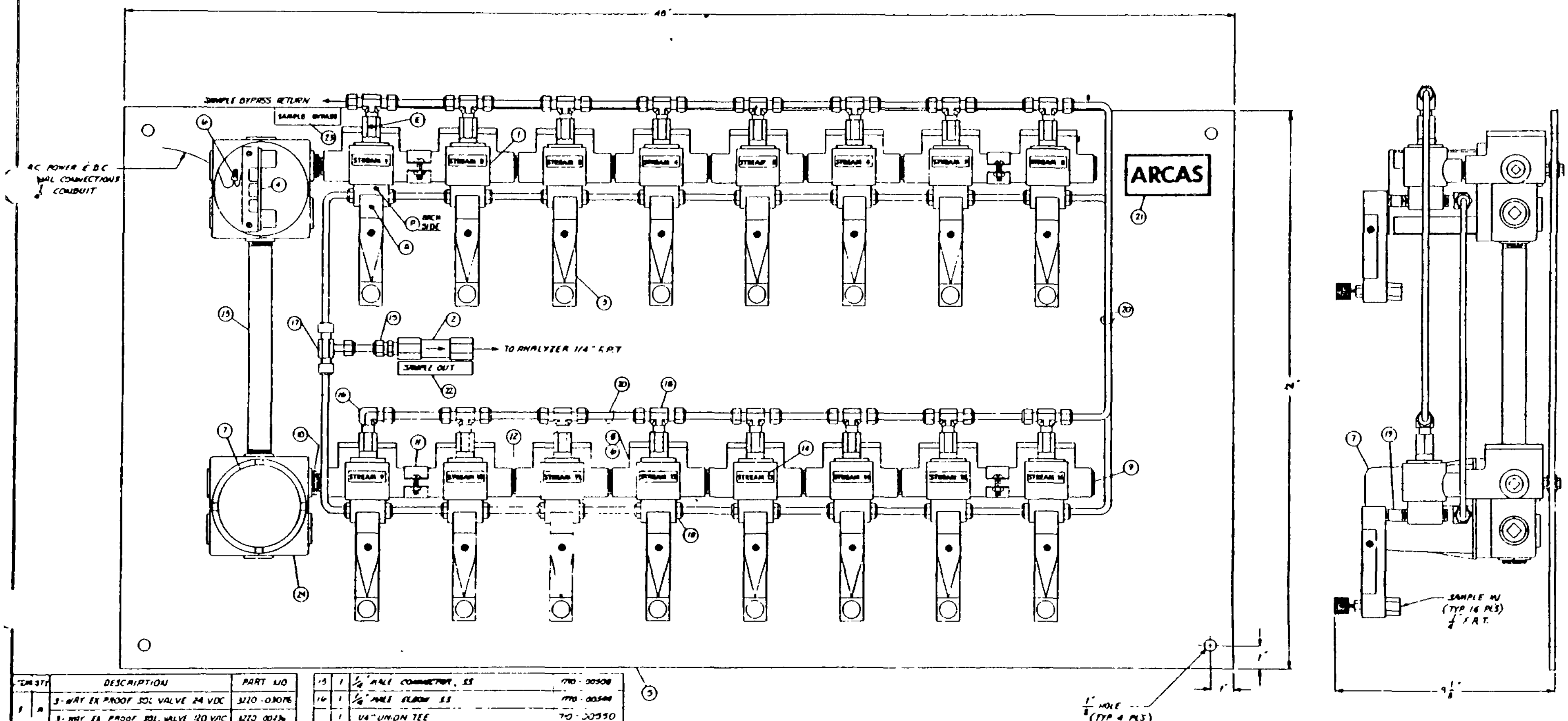
MODEL 1905
PANEL OR RACK MOUNT
SWITCH MEMORY
OR
DATA ENTRY
DIGITAL TIMERS



MODEL 405 — PANEL MOUNT
DATA ENTRY
DIGITAL TIMER



MODEL 505
FIELD MOUNTED, AIR PURGED
PROGRAMMER,
SWITCH MEMORY OR
DATA ENTRY DIGITAL TIMER



ITEM	QTY	DESCRIPTION	PART NO
1	A	3-WAY EX PROOF SOL VALVE 24 VDC	3220-03076
		3-WAY EX PROOF SOL. VALVE 120 VAC	3220-00236
2	1	FILTER, IN LINE - S.S	4563-02174
3	A	ROTAMETER S.S	3215-00432
4	A	ANALYZER RELAY CARD (LAST DIGIT FOR NO. OF ANALYST)	3040-0294 ☐
5	1	FIBERGLASS BACKBOARD 24" x 48"	2935-00376
6	A	WIRE NUT, TYPE-Y (18-20 AWG)	2436-00220
7	A	GRP. DOME	2805-00375
8	A	CONDUIT TEE GUAT-14	2805-00376
9	A	1/2" CONDUIT PLUG	2810-00590
10	A	3/4" - 1/2" CONDUIT RED BUSHING	2810-00391
11	A	1" CONDUIT HANGER (STEEL CITY #8)	2810-00384
12	A	1/2" CONDUIT CLOSE NIPPLE	2815-00402
13	A	1/2" CONDUIT NIPPLE 10" LONG	2815-02660
14	A	TAG: STREAM 1 THRU 16	2590-00544 THRU 00559
15	1	1/4" MALE CONNECTOR, SS	1770-00508
16	1	1/4" MALE ELBOW SS	1770-00544
17	1	1/4" UNION TEE	1710-00550
18	A	1/4" MALE BRANCH TEE, SS	1770-02280
19	A	1/4" PIPE NIPPLE, 1 1/2" LONG	1720-04600
20	AR	1/8" TUBING, SS T-304	1730-02198
21	1	TAG, ARCAS	2590-00416
22	1	TAG; SAMPLE OUT	2590-00530
23	1	TAG; SAMPLE BYPASS	2590-02534
24	A	ANALYZER RELAY CARD GUP 215 MOD	2305-01380

NOTES

A CHOOSE TYPE & QUANTITY TO SUIT APPLICATION

B (A) (C) (P) PORT NOS

THE ARCAS COMPANY
HOUSTON, TEXAS

TITLE MULTI-STREAM SAMPLE SYSTEM

FOR

SCALE 1/4 = 1

DRAWN

DATE 10-27-75

CHECKED

APPROVED

A | ADD LIST PARTS REV

NO. | BY | REVISION | DATE | APP

JOB NO.

DRAWING NO. 15-206

R