CDM SOIL SAMPLE SPLITS

SUBTASK 2D - SUBSURFACE SOIL SAMPLING

SOUTH CAVALCADE SITE

HOUSTON, TEXAS

002633

FOR

KOPPERS COMPANY, INC.

PITTSBURGH, PENNSYLVANIA

PREPARED BY

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MCBRIDE-RATCLIFF AND ASSOCIATES, INC.

HOUSTON, TEXAS

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McBride-Ratcliff and Associates, Inc.

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HOUSTON, TEXAS

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Koppers Company, Inc., Science and Technology
436 Seventh Avenue, Pittsburgh, PA 15219
Telephone 412-227-2000

KOPPERS

RECEIVED
EPA REGION VI
1986 MAY 30 AM 10 35
SUPERFUND BRANCH

May 27, 1986

Mr. Larry Wright
Chief, Superfund Enforcement Section
US Environmental Protection Agency
Region VI
1201 Elm Street
6AW-SE
Dallas, TX 75270

Re: South Cavalcade Site
Split Sample Results

002636

Dear Mr. Wright:

Attached please find a copy of Mc-Bride-Ratcliff's sample split analyses. As you recall, we had arranged for 5 soil samples each from the North and South Cavalcade sites to be processed as per the respective soils surrogate programs.

Also, please find enclosed a copy of McBride-Ratcliff's daily field activity logs for the week of May 12, 1986.

Should you have any questions, please contact this office.

Sincerely yours,

Jerma R. Campbell

for S. Michael Tymiak, P. E.
Manager, Previously Operated Properties.

JRC:m
KSC-RI/FS-43
cc: D. Sorrels (TWC)
B. Keir (CDM)

McBride-Ratcliff and Associates, Inc.
Geotechnical Consultants
7220 Langtry Houston, Texas 77040 713-460-3766

May 16, 1986
MRA Project No. 85-317

002637

Koppers Company, Inc.
1940 Koppers Building
436 Seventh Avenue
Pittsburgh, Pennsylvania 15219

ATTENTION: Dr. James R. Campbell
Previously Operated Properties

SUBJECT: CDM Soil Sample Splits
Subtask 2D - Subsurface Soil Sampling
South Cavalcade Site
Houston, Texas

Presented here is the report of our laboratory test results of selected soil sample splits with Camp, Dresser & McKee (CDM) for the remedial investigation at the South Cavalcade Site in Houston, Texas. This work was requested by Mr. John Cochran of the Region VI EPA at our meeting on February 13, 1986 and verbally authorized by Dr. Jim Campbell.

Introduction

A total of 10 selected soil samples were obtained for comparative evaluation of total aromatic hydrocarbon compounds by using fluorescence spectrophotometry and gas chromatography analytical methods. Five selected soil samples were obtained from both the North Cavalcade and South Cavalcade Sites and split with representatives of McBride-Ratcliff and Associates (MRA) and Camp, Dresser & McKee (CDM). The samples were selected to represent a range of suspected contaminant concentrations.

Sample Splits

The MRA samples were obtained from various depths at Boring SCK-A04-SB02 on March 6, 1986. The samples were split with representatives of CDM and then placed into 16 oz., detergent-washed glass jars with Teflon-lined lids. The soil samples were transported to our Houston laboratory on March 6, 1986 under cooled conditions with chain-of-custody documentation. A copy of the MRA chain-of-custody record is included in Appendix A.

On March 6, 1986 a total of five sample splits were obtained from representatives of CDM. The samples were consecutively numbered 01 to 05 and were received in 4 oz. glass jars. A copy of the CDM chain-of-custody record is also included in Appendix A.

Surrogate Testing

Surrogate testing was conducted for all 10 split soil samples. Qualitative metals screening was conducted using a X-ray fluorescence analyzer. Aromatic hydrocarbon measurements were made using a fluorescence spectrophotometer.

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Soil Metals Screening. Qualitative metals screening for the split soil samples was conducted using a Columbia Scientific Industries Corporation (CSI) X-Met 840 portable X-ray analyzer. In general accordance with the EPA Work Plan, the following metals were included in the screening: arsenic, chromium, copper, lead, and zinc. The X-ray analyzer was calibrated by CSI based on comparisons with metals concentrations measured by atomic absorption techniques.

The prepared samples were subject to a 100 mCi Cm-244 source for 200 seconds. X-ray intensities were recorded for arsenic, chromium, copper, lead, zinc, and back-scattered radiation. A standard deviation of counting statistics was also recorded for each measurement. Details of the procedures used for sample preparation and machine operation are given in SOP-HWCL-03, Method of X-Ray Fluorescence Analysis of Metals in Soil, included in Appendix B.

Aromatic Hydrocarbon Screening. Total aromatic hydrocarbon concentrations of the split soil samples were measured by using a Perkin-Elmer LS-3 Spectrofluorometer. The soil samples were extracted using cyclohexane. The filtered extracts were diluted to stay within the detection limits of the spectrofluorometer. The spectrofluorometer uses scanning monochromators which scan from 200 to 720 nm for excitation wavelengths ad 230-800 nm for emission wavelengths. A Bausch and Lomb strip chart recorder was used to record the spectral scans.

Spectral scans were obtained for each sample extract. Spectral scanning consists of scanning excitation and emission monochromators simultaneously with a wavelength difference of 5 to 35 nm. For this investigation, a fixed

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wavelength difference of 20 nm was used. This difference was sufficient to negate the effects of cyclohexane caused by Rayleigh-Tyndall and Raman Scattering. The scanning range was from 250 to 430 nm and 270 and 450 nm for the excitation and emission monochromators, respectively. The lower values were chosen because they are above the excitation and emission wavelengths of the cyclohexane but below the excitation and emission wavelengths for the standards. The upper limits were chosen based on the range of excitation wavelengths within the UV region.

Spectral scans of the sample extracts were compared to a creosote standard of known concentration. Reported total aromatic hydrocarbon concentrations are relative to the creosote standard.

Details of the procedures and methods used for aromatic hydrocarbon screening are given in SOP-HWCL-01, Method of Fluorescence Analysis of Total Polynuclear Aromatic Hydrocarbons in Soil, included in Appendix C. Copies of the sample spectral scans are included in Appendix D.

Test Results

Appendix E presents a computerized summary of the split sample surrogate test results. Also included in the summary are the calculated machine detection limits and the standard deviation for each soil metals measurement. The standard deviation is reported as the greater of the standard deviation from the calibration model and the standard deviation of counting statistics. The detection limits of the fluorescence spectrophotometer were calculated by successively diluting a standard until it gave no measured spectral response.

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Summary

A review of the surrogate test data indicates a range of total aromatic hydrocarbon concentrations.

We appreciate this opportunity to be of service to Koppers Company. Please contact us if you require additional information.

Sincerely,

McBRIDE-RATCLIFF AND ASSOCIATES, INC.

William R. Tobin

William R. Tobin, P.E.
Project Manager

Paul R. Wild

Paul R. Wild
Project Chemist

WRT:PRW:kc
Copies Submitted - 6

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APPENDIX A

CHAIN-OF-CUSTODY DOCUMENTATION

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CHAIN OF CUSTODY RECORD

PROJECT NO.: 85 317

PAGE 1 OF 4

LOCATION: South Galveston

DATE: 3/6/86

TIME	SAMPLER	CONTAINERS	SAMPLE TYPE: GRAB	COMPOSITE	SOIL	WATER	MRA SAMPLE NUMBER / LAB SAMPLE NUMBER	Arsenic	Chromium	Copper	Lead	Zinc	Fluoride		DUE DATE
0830	WDT	1			✓		SCK-A04-SB02-01, 1.5	✓	✓	✓	✓	✓	✓		
0837	WDT	1			✓		SCK-A04-SB02-02, 4'	✓	✓	✓	✓	✓	✓		
0845	WDT	1			✓		SCK-A04-SB02-03, 6'	✓	✓	✓	✓	✓	✓		
0854	WDT	1			✓		SCK-A04-SB02-04, 7.5'	✓	✓	✓	✓	✓	✓		
0900	WDT	1			✓		SCK-A04-SB02-05, 10'	✓	✓	✓	✓	✓	✓		
0913	WDT	1			✓		SCK-A04-SB02-06, 11'	✓	✓	✓	✓	✓	✓		
0920	WDT	1			✓		SCK-A04-SB02-07, 13.5'	✓	✓	✓	✓	✓	✓		

RELINQUISHED BY	DATE	TIME	RECEIVED BY	DATE	TIME	SAMPLE CONDITIONS
Greg Hassell	3/6/86	1800	Glen Nelson	3/6/86	1800	All samples have sanitary lids on top.

McBride-Katcliff and Associates, Inc.

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CHAIN OF CUSTODY RECORD

PROJECT NO.: 85-317

PAGE 2 OF 4

LOCATION: Kuper's, South Calvacade

DATE: 3/6/86

TIME	SAMPLER	CONTAINERS	SAMPLE TYPE: GRAB	COMPOSITE	SOIL	WATER	MRA SAMPLE NUMBER / LAB SAMPLE NUMBER	Arsenic	Chromium	Copper	Lead	Zinc	Fluorescence		DUE DATE
0930	WDT	1			✓		SCK-A04-SB02-08, 15.5	✓	✓	✓	✓	✓	✓		
1043	WDT	1			✓		SCK-A04-SB02-09, 24'	✓	✓	✓	✓	✓	✓		
1055	WDT	1			✓		SCK-A04-SB02-10, 25.5	✓	✓	✓	✓	✓	✓		
1107	WDT	1			✓		SCK-A04-SB02-11, 28'	✓	✓	✓	✓	✓	✓		
1127	WDT	1			✓		SCK-A04-SB02-12, 30'	✓	✓	✓	✓	✓	✓		
1127	WDT	1			✓		SCK-A04-SB02-13, 32'	✓	✓	✓	✓	✓	✓		
11:35	WDT	1			✓		SCK-A04-SB02-14, 34	✓	✓	✓	✓	✓	✓		

RELINQUISHED BY	DATE	TIME	RECEIVED BY	DATE	TIME	SAMPLE CONDITIONS
Greg Hassell	3/6/86	1800	Glenn Nelson	3/6/86	1800 ~~SAT~~	All Sample have Sanitary dots ontop.

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CHAIN OF CUSTODY RECORD

PROJECT NO.: 85-317

PAGE 3 OF 4

LOCATION: Kepper's South Calvacade

DATE: 3/6/86

TIME	SAMPLER	CONTAINERS	SAMPLE TYPE: GRAB	COMPOSITE	SOIL	WATER	MRA SAMPLE NUMBER / LAB SAMPLE NUMBER	ANALYSIS REQUIRED: Arsenic	Chromium	Copper	Lead	Zinc	Phenol screen		DUE DATE
~~11:35~~	~~WDT~~	~~1~~			~~✓~~		~~SCK-A04-SB02-14, 34'~~								
11:43	WDT	1			✓		SCK-A04-SB02-15, 35	✓	✓	✓	✓	✓	✓		
11:52	WDT	1			✓		SCK-A04-SB02-16, 28'	✓	✓	✓	✓	✓	✓		
12:01	WDT	1			✓		SCK-A04-SB02-17, 38.5'	✓	✓	✓	✓	✓	✓		
12:12	WDT	1			✓		SCK-A04-SB02-18-41.5'	✓	✓	✓	✓	✓	✓		
12:24	WDT	1			✓		SCK-A04-SB02-19, 44'	✓	✓	✓	✓	✓	✓		
12:43	WDT	1			✓		SCK-A04-SB02-20 44.5	✓	✓	✓	✓	✓	✓		

RELINQUISHED BY	DATE	TIME	RECEIVED BY	DATE	TIME	SAMPLE CONDITIONS
Greg Hassett	3/6/86	1800	Glenn Nelson	3-6-86	1800	All Samples have Sanitary dots on top

McBride-Ratcliff and Associates, Inc.

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CHAIN OF CUSTODY RECORD

PROJECT NO.:

LOCATION: Kappers South Coalinda

DATE: 3/6/86

PAGE 4 OF 4

TIME	SAMPLER	CONTAINERS	SAMPLE TYPE: GRAB	COMPOSITE	SOIL	WATER	MRA SAMPLE NUMBER / LAB SAMPLE NUMBER	ANALYSIS REQUIRED: Arsenic	Chromium	Copper	Lead	Zinc	Fluorescence		DUE DATE
12:57	WDT	1			✓		SCK-A04-SB02-21, 47	✓	✓	✓	✓	✓	✓		
13:08	WDT	1			✓		SCK-A04-SB02-22, 49.5	✓	✓	✓	✓	✓	✓		
13:20	WDT	1			✓		SCK-A04-SB02-23, 50'	✓	✓	✓	✓	✓	✓		
13:33	WDT	1			✓		SCK-A04-SB02-24, 54'	✓	✓	✓	✓	✓	✓		
13:45	WDT	1			✓		SCK-A04-SB02-25, 55	✓	✓	✓	✓	✓	✓		
14:10	WDT	1			✓		SCK-A04-SB02-26, 57.5	✓	✓	✓	✓	✓	✓		
14:23	WDT	1			✓		SCK-A04-SB02-27, 59.5	✓	✓	✓	✓	✓	✓		

RELINQUISHED BY	DATE	TIME	RECEIVED BY	DATE	TIME	SAMPLE CONDITIONS
Greg Hassett	3/6/86	1800	Glen Urban	3/6/86	1800	All Jars have Sanitary dots on top

McBride-Ratcliff and Associates, Inc.
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EN[redacted]ONM[redacted]AL P[redacted]ECTI[redacted]GEN[redacted] Re[redacted]N 6

Office nforcement

First International Bldg. 1 Elm St.
Dallas, Texas 75270

CHAIN OF CUSTODY RECORD

PROJ. NO.: 141

PROJECT NAME: Moath Cavalcade

SAMPLERS: (Signature) [signature] / [signature]

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	4 oz glass, Soil						REMARKS
Split	1986												
#01	3/5	1530		✓	Moath Cavalcade	1							Splits w/ CDM / South -
#02	3/5	1546		✓	" "	1							Western Lab
#03	3/6	1605		✓	" "	1							
#04	3/6	1617		✓	" "	1							
#05	3/6	1636		✓	" "	1							

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	3/6/86 1700	Wayne O. Tr[signature]	Wayne O. Tr[signature]	3-7-86 1547	[signature]
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

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APPENDIX B

SOP-HWCL-03

METHOD OF X-RAY FLUORESCENCE

ANALYSIS OF METALS IN SOIL

002648

STANDARD OPERATING PROCEDURE

Number:	SOP-HWCL-03	Page:	1 of 7
Originated By:	PRW	Date:	Jan. 1986
Approved By:	WRT	Status:	Final
		Rev.:	0

****

METHOD OF X-RAY FLUORESCENCE ANALYSIS OF METALS IN SOIL

1.0 Scope and Application

1.1 This procedure is for the qualitative analysis of metals in soil using an X-ray fluorescence analyzer. A radioactive source is chosen which emits X-rays to obtain spectral responses from metal compounds in a soil media. Metals can be identified and quantified by the characteristic energies which they re-emit. Typical lower detection limits are 25 to 50 ppm in complex soil media.

2.0 Summary of Method

2.1 A dried and homogenized soil sample is placed in a calibrated X-ray fluorescence analyzer and subjected to X-rays. Re-emitted X-rays are detected and analyzed to identify metals and their concentrations.

3.0 Apparatus and Materials

3.1 A Columbia Scientific Industries X-Met 840 Portable X-Ray Analyzer with powder/liquid sample probe.

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3.2 Analytical balance capable of weighing to 0.1gm.

3.3 Plastic sample cups and mylar film from Columbia Scientific Industries.

3.4 Drying oven capable of maintaining a constant temperature of 105° C.

3.5 Grinder, ball mill grinder, mortar and pestle, or similar apparatus capable of reducing dry soils to fine powders.

3.6 Glass cutting board and stainless steel knife or device to grate the sample.

3.7 U.S. Standard Sieve No. 10 (2.00 mm) and U.S. Standard Sieve No. 200 (0.075 mm).

4.0 Sample, Preservation, and Handling

4.1 Samples shall be stored in detergent washed, tap water rinsed 8 oz. or 16 oz. glass jars with Teflon-lined lids at 4°C. Maximum holding time for soil samples is 6 months. At least 100 gm of soil is required.

5.0 Procedure

5.1 Remove the sample from the jar and place it on a glass cutting board. With a stainless steel knife or grating device, break the sample down to 1/4-in. pieces or less and thoroughly mix the samples.

5.2 Fill a weighing dish with about 50 gm of soil and record the weight of the soil. Dry the soil for 24 hours at a constant temperature of 105°C. Weigh the dried soil and compute the moisture content on a dry weight basis, in accordance with ASTM D 2216.

5.3 Grind the samples in the grinding apparatus until they are fine powders. Samples with gravel and large organic materials should be sieved first with a U.S. Standard Sieve No. 10. Weigh and record the weight of material retained on the sieve. After grinding is complete, the powders should be sieved with a U.S. Standard Sieve No. 200. Materials passing the U.S. Standard Sieve No. 200 are to be used for the analysis. Samples with high concentrations of organic compounds may not pass the No. 200 sieve and should be sieved with a U.S. Standard Sieve No. 10 if less than 5 gm pass the No. 200 sieve.

5.4 Prepare the sample cup by placing a piece of the mylar film over the bottom of the larger half of the sample cup. Snap the smaller half of the sample cup over the bottom of the larger half. This clamps the mylar film in place. The film should be tight, without wrinkles.

5.5 Fill the cup with the dried, pulverized samples. Tap the cup on a hard surface until no more settling is observed to occur and the sample surface is visually flat and uniform. A 1/4 in. to 1/2 in. layer of sample should be in each cup.

5.6 Turn the X-MET 840 on. The LCD should read "SELF TEST COMPLETE" and the ">" sign should be displayed. This display may be replaced by "GAIN CONTROL: COUNT RATE TOO LOW". This is normal. Allow the machine to warm up for at least 1/2 hour with the probe lid closed. Open up the lid and wait an additional 5 minutes for gain control stabilization. The instrument is ready to measure samples. Keep the lid of the probe open for gain control between the sample analyses.

5.7 Place the sample cup in the probe, making sure the lid is completely closed, and press "START".

After it has finished scanning, "ASSAYS" will appear and the metals of interest and their concentrations (mg/kg dry weight basis) will appear on the screen. Record the results on the X-ray Analysis Data Sheet. Enter "STD" on the keypad after each measurement and record the standard deviation of counting statistics for each metal. Store the samples in glass storage vials for future reference. Report results by total wet weight. Calculations are as follows:

$$\frac{\text{Sample Dry wt.}}{\text{Sample Wet wt.}} \times \text{Results (mg/kg)} = \text{Corrected Results (mg/kg)}$$

For samples that were sieved with a U.S. Standard Sieve No. 10, the weight of materials retained should be subtracted from the sample dry weight in the calculations:

$$\frac{\text{Sample Dry wt.} - \text{Retained Sample wt.}}{\text{Sample Wet wt.}} \times \text{Results (mg/kg)} = \text{Corrected Results (mg/kg)}$$

6.0 Equipment Cleanup

6.1 The knife, grating device, and cutting board should be detergent washed and tap water rinsed to

remove all dirt and air dried between samples. The cups should be detergent washed and tap water rinsed between samples and air dried. Replace the mylar film between each analysis.

7.0 Quality Assurance/Quality Control Measures

7.1 Ten percent of the samples will have a replicate analysis to evaluate analytical precision. Randomly choose 1 sample and prepare a separate aliquot and perform analysis in accordance with Section 5.0. Record the results on the X-Ray Analysis Data Sheet. Record the respective standard deviations of counting statistics.

7.2 Compute the differences for each metal concentration between the original analysis and the replicate analysis. If any values differ by greater than 2 reportable standard deviations, then conduct a second relicate analysis on a third aliquot from the same sample. Reportable standard deviation is defined as the greater of the two values of the standard deviation of counting statistics and the calibration model standard deviation.

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7.3 To check for instrument precision, perform an analysis of a known standard. This should be performed once per day. If the average of the standard results vary greater than 2 reportable standard deviations, then open the lid of the probe to allow it to undergo gain control for 15 minutes. Remeasure the sample.

8.0 References

8.1 Operating Instructions: X Met 840 Portable XRF Analyzer, Columbia Scientific Industries, 1985.

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X-RAY ANALYSIS DATA SHEET

PROJECT NO.:	PROJECT:	CLIENT:
DATE TESTED:	BY:	

SAMPLE NO.	DEPTH	SAMPLE DATE	TARE WEIGHT	CAN PLUS WET SOIL	CAN PLUS DRY SOIL	WATER CONTENT	METALS CONCENTRATION/SAMPLE STANDARD DEVIATION				
							ARSENIC	CHROMIUM	COPPER	LEAD	ZINC
							MODEL SD=32 MODEL DL=68	MODEL SD=204 MODEL DL=88	MODEL SD=42 MODEL DL=28	MODEL SD=182 MODEL DL=101	MODEL SD=58 MODEL DL=30

REPLICATE SAMPLE NO.	METAL	STANDARD VALUE / END-OF-DAY VALUE	DEV.					
				REPLICATE 1 RESULTS				
STANDARD SAMPLE NO.	As	1578 ± 67		DIFFERENCE				
	Cr	1435 ± 200		LESS THAN 2 STANDARD DEVIATIONS ?	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
CHECKED BY:	Cu	427 ± 37		REPLICATE 2 RESULTS				
DATE:								
STATUS:	Pb	174 ± 63		DIFFERENCE				
☐ DRAFT ☐ FINAL	Zn	2612 ± 56		LESS THAN 2 STANDARD DEVIATIONS ?	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

McBride-Ratcliff and Associates, Inc.

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APPENDIX C

SOP-HWCL-01

METHOD OF FLUORESCENCE ANALYSIS

OF TOTAL

POLYNUCLEAR AROMATIC HYDROCARBONS

IN SOIL

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METHOD OF FLUORESCENCE ANALYSIS OF TOTAL POLYNUCLEAR AROMATIC HYDROCARBONS IN SOIL

1.0 Scope and Application

1.1 This procedure is for the extraction of polynuclear aromatic hydrocarbons (PNA) from soil and analysis of the extract by fluorescence spectrophotometry. This procedure determines total PNA only and cannot resolve the various components of a complex matrix.

1.2. Potential causes for negative interference are paramagnetic species such as dissolved oxygen, iron, copper, and nickel. Other negative interferences are self-quenching and energy transfer quenching. Diamagnetic metals such as zinc and calcium may cause positive interferences. Changes in pH can cause positive or negative interferences. Substituents such as: $-Cl$, $-NO_2$, or $-CO_2H$ tend to quench fluorescence whereas substituents such as: $-NH_2$, $-OH$, or $-OCH_3$ tend to enhance fluorescence.

2.0 Summary of Method

2.1 A soil sample is partially homogenized manually. A portion of this sample is then completely

homogenized. One gram of the homogenized sample is extracted in cyclohexane, and the extract is analyzed by the synchronous excitation method of fluorescence spectrophotometry to obtain a spectral response. The spectral response is compared to a standard of known PNA concentration for determination of relative total polynuclear aromatic hydrocarbon concentration.

3.0 Apparatus and Materials

3.1 Scanning fluorometer capable of simultaneously scanning the excitation wavelengths from 230 to 500+ nm and the emission wavelengths from 250 to 520+ nm.

3.2 Quartz cuvette with 10 mm path length.

3.3 Rotary tumbler, shaker, or similar device for constant agitation of soil sample.

3.4 Spectral grade cyclohexane.

3.5 Mortar and pestle.

3.6 Glass cutting board and stainless steel knife or device to grate the soil sample.

3.7 A filtering apparatus consisting of Whatman 40 filter paper, glass funnel, suction flask, suction flask adapter, aspirator pump, and tubing.

3.8 Balance capable of weighing to 0.01 mg.

4.0 Sample Collection, Preservation, and Handling

4.1 Soil samples shall be stored in detergent washed, tap water rinsed, 8 oz. or 16 oz. glass jars with Teflon-lined lids.

5.0 Procedure

5.1 Remove the soil sample from the jar (minimum 100 grams) and place on a glass cutting board. With the stainless steel knife or grating device, break down the sample to 1/4-in. sized pieces or less and thoroughly mix the pieces. Thoroughly grind and homogenize the soil with a mortar and pestle, grinder, or ball mill.

5.2 Place 1 gram of the homogenized soil sample onto a weighing paper which has been prewashed in cyclohexane and air dried.

5.3 Add 100 ml of cyclohexane and agitate the soil sample in the extraction apparatus for at least 24 hrs. The extraction apparatus should continuously agitate the sample.

5.4 Filter the extract and place 3 ml of the filtrate in the cuvette. Simultaneously scan the emission wavelengths from 250 to 500 nm and the excitation wavelengths from 270 to 520 nm. The strip chart speed, scan rate, and fixed scale should be at the same settings as for the standard against which the scan is compared.

5.5 Dilution may be necessary to keep the instrument response on scale. If dilution is necessary, place 1 ml of the extract into another glass jar, and add cyclohexane. Several dilutions may be necessary for the instrument response to remain on scale. The dilution factor is calculated as follows:

DF = extract volume x total dilution volume

5.6 The response constant from the standard is calculated as follows:

$$RC\left(\frac{\text{mg PNA/ml}}{\text{units}}\right) = \frac{\text{mg PNA/standard dilution factor}}{\text{standard area units}}$$

5.7 Measure the area under the peaks of the spectral scan. Calculations are as follows:

$$\text{Total PNA}\left(\frac{\text{mg}}{\text{kg}}\right) = \frac{\text{sample area units} \times RC \times DF}{\text{sample weight (kg)}}$$

5.8 The instrument detection limit is determined by diluting a known concentration of a standard until it no longer registers a spectral response, when background corrections are made. The analytical detection limits are determined by multiplying the instrument detection limit by the dilution factor for each analysis.

5.9 Record all data and calculations on the Spectral Scan Data Sheet, which is to be attached to the fluorescence spectrum of the sample.

6.0 Equipment Cleanup

6.1 All equipment exposed to soil samples or soil extracts must be detergent washed and tap water rinsed followed by a cyclohexane rinse. This includes the knife and/or grating device, cutting board, funnel, extraction bottles, etc. The cuvette must be washed by an ammonia-based glass cleanser, tap water rinse, distilled water rinse, followed by a cyclohexane rinse. Repeat the process until no contamination is visually evident. Filters and weighing papers should be prewashed by placing in a beaker of cyclohexane for 15 minutes. Air dry filters and weighing papers overnight after washing and store to avoid dust accumulation.

7.0 Quality Assurance/ Quality Control Measures

7.1 One out of every ten samples should have a replicate analysis from the same extract. If the replicate sample results vary more than 10 percent from the original analysis, a second duplicate analysis should be conducted on a different sample.

7.2 A rinseate blank should be analyzed consisting of cyclohexane exposed to glassware, cutting board, knife, and analytical materials for every ten samples analyzed.

002664

APPENDIX D

SAMPLE SPECTRAL SCANS

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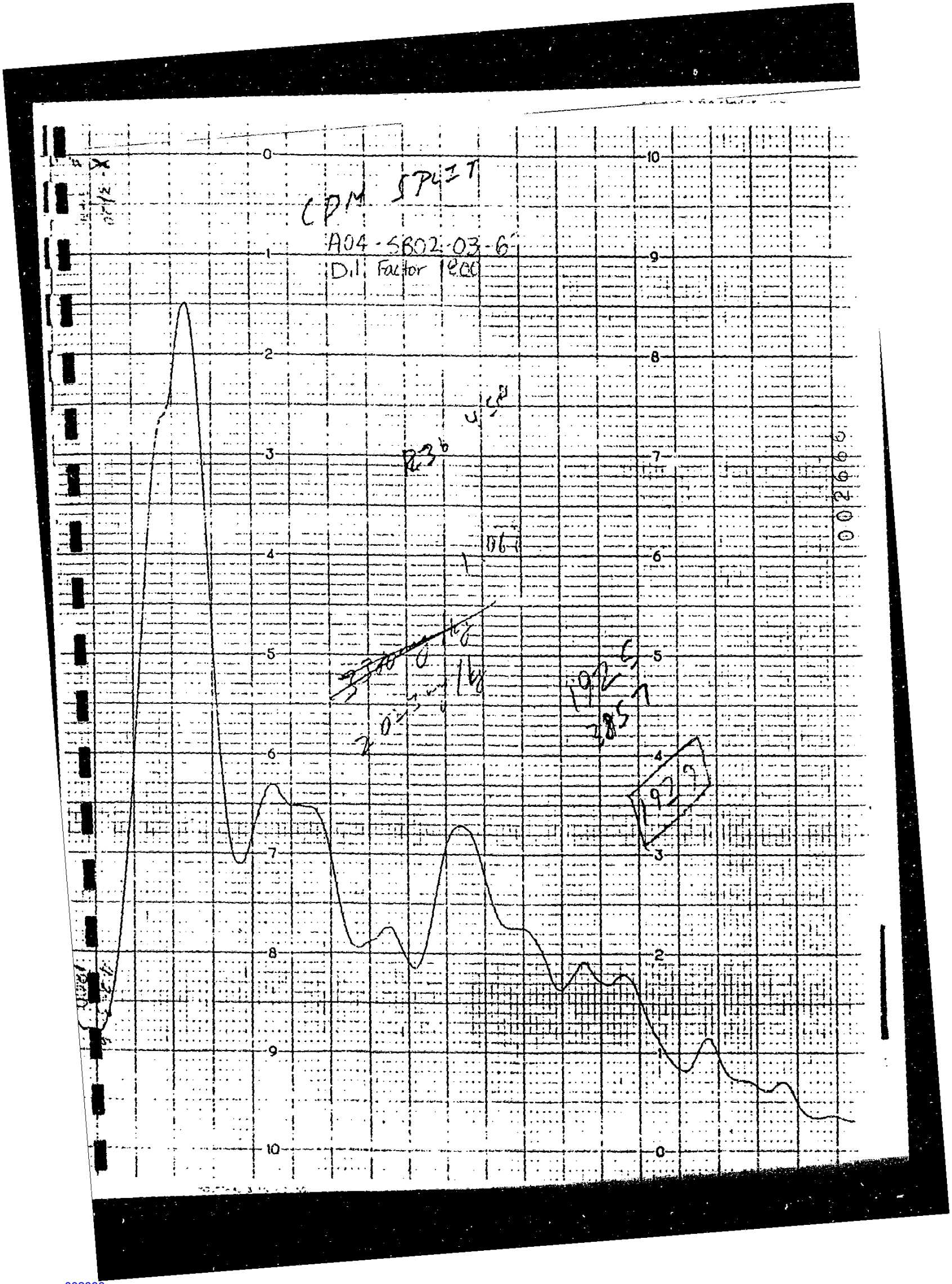
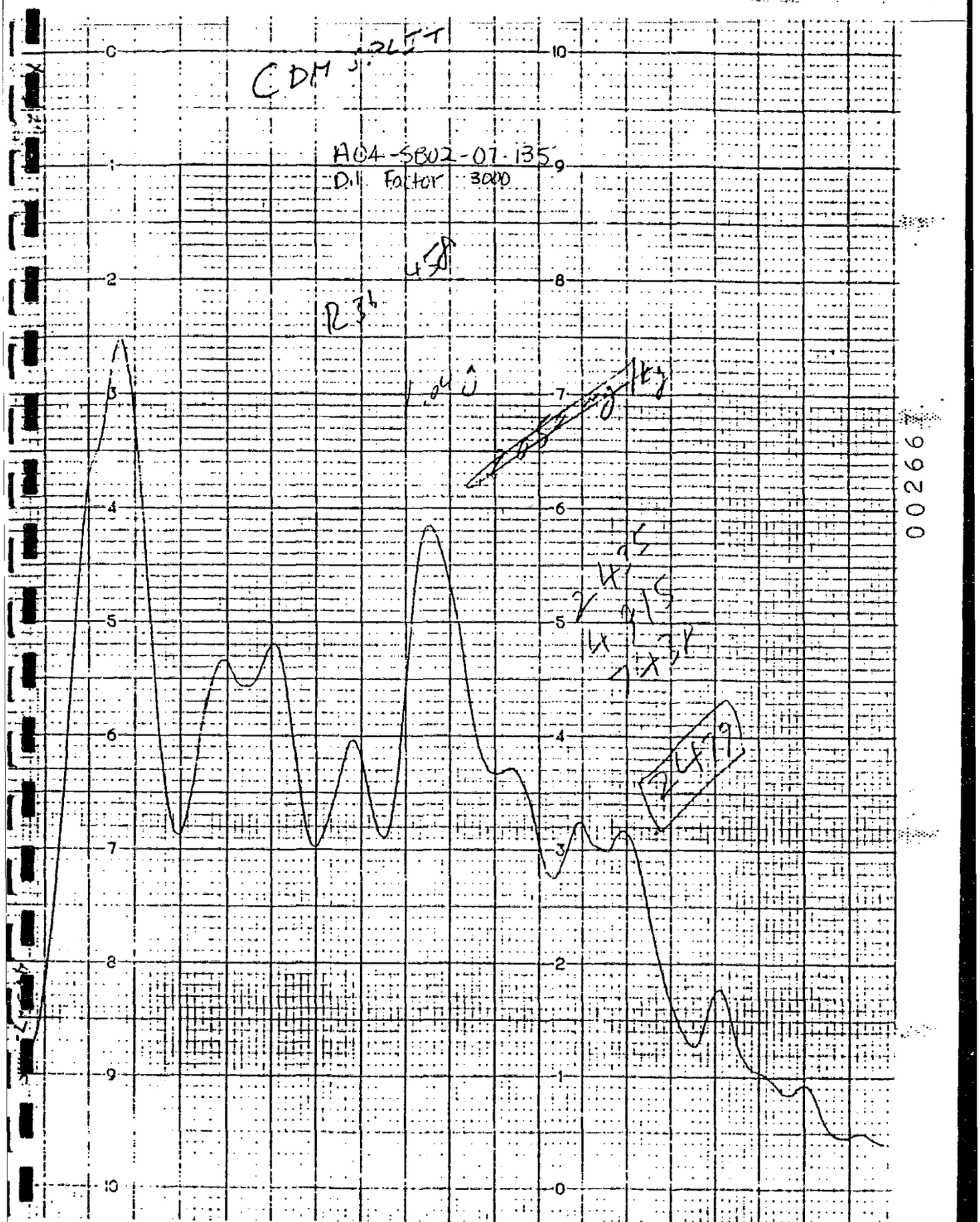
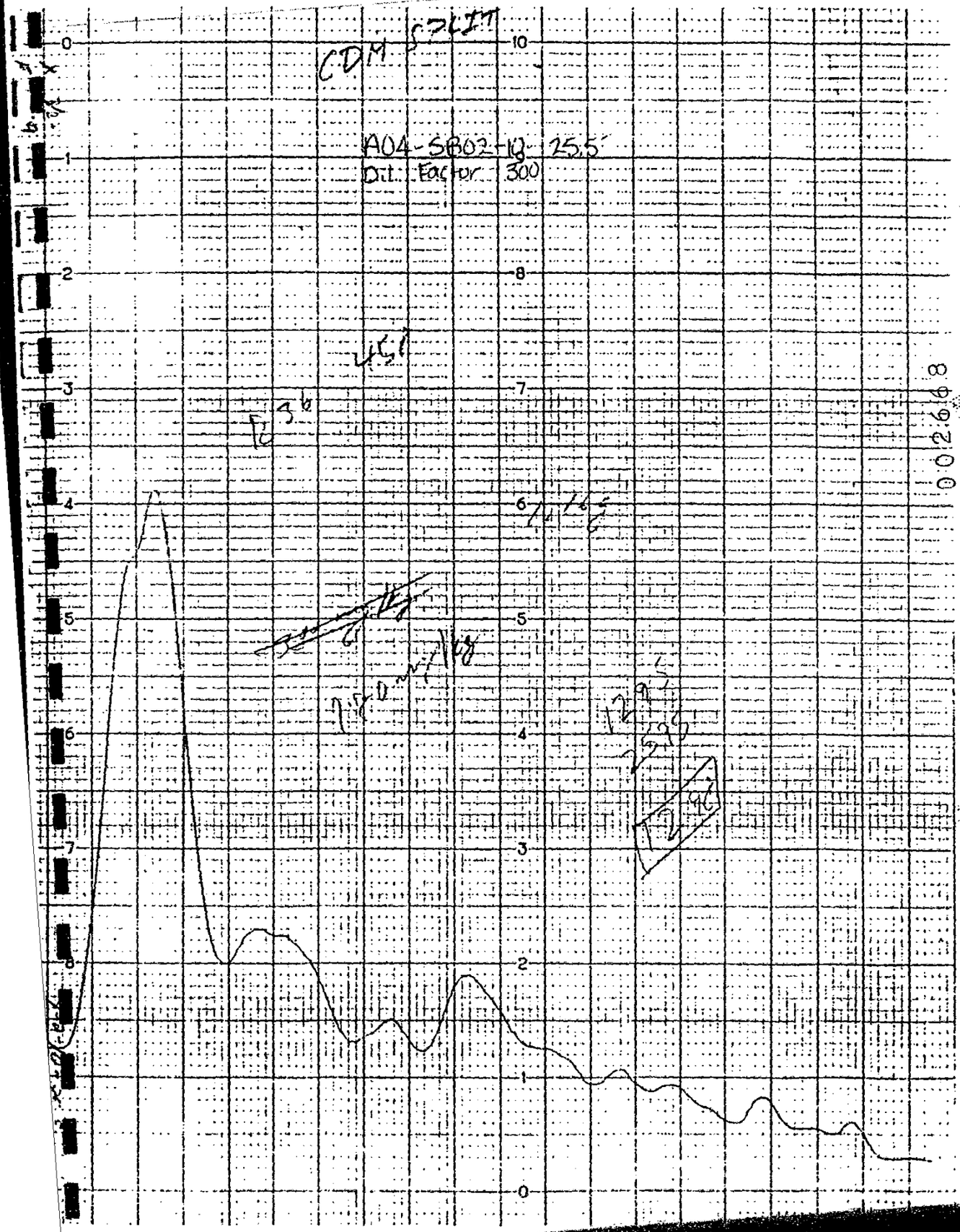
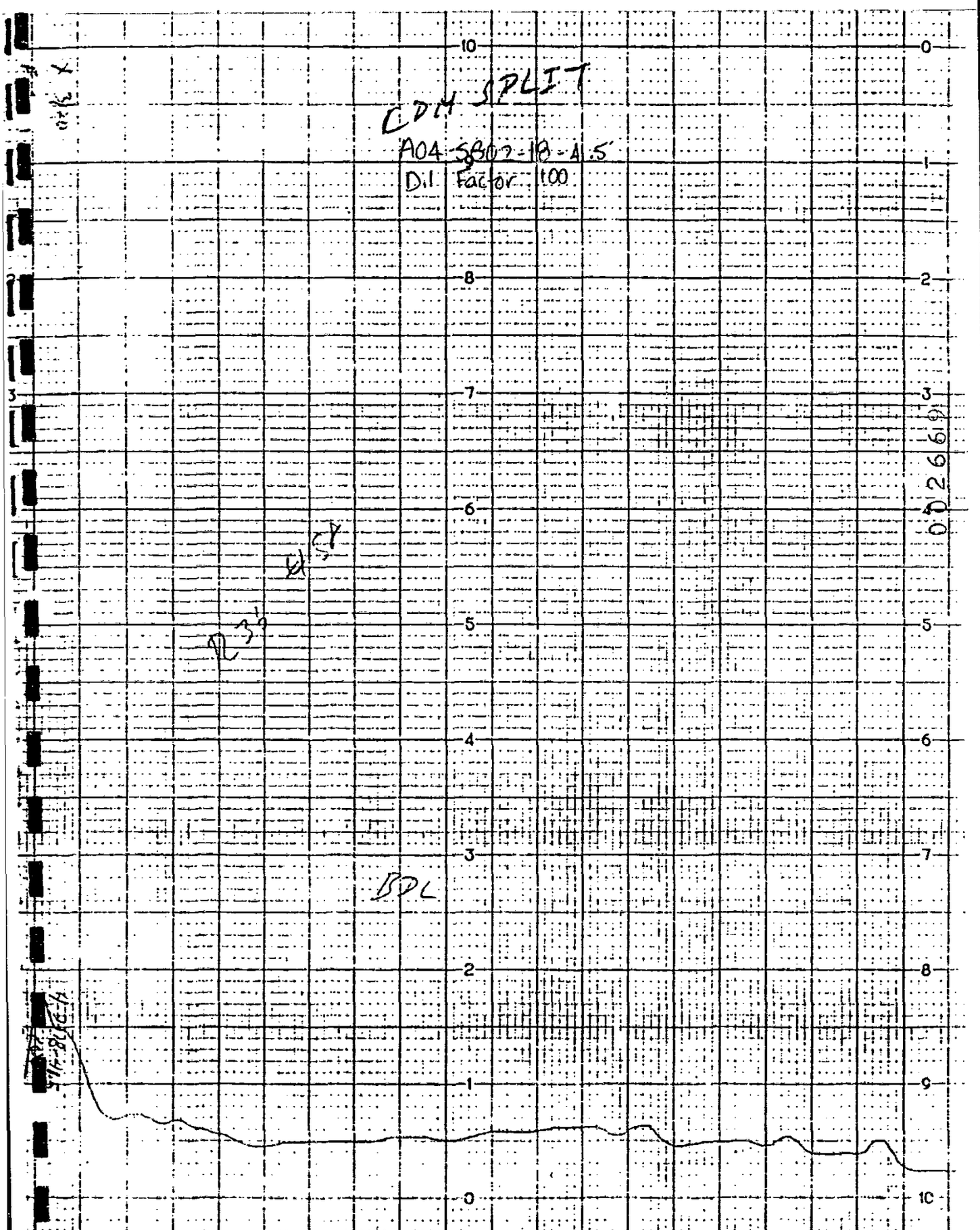
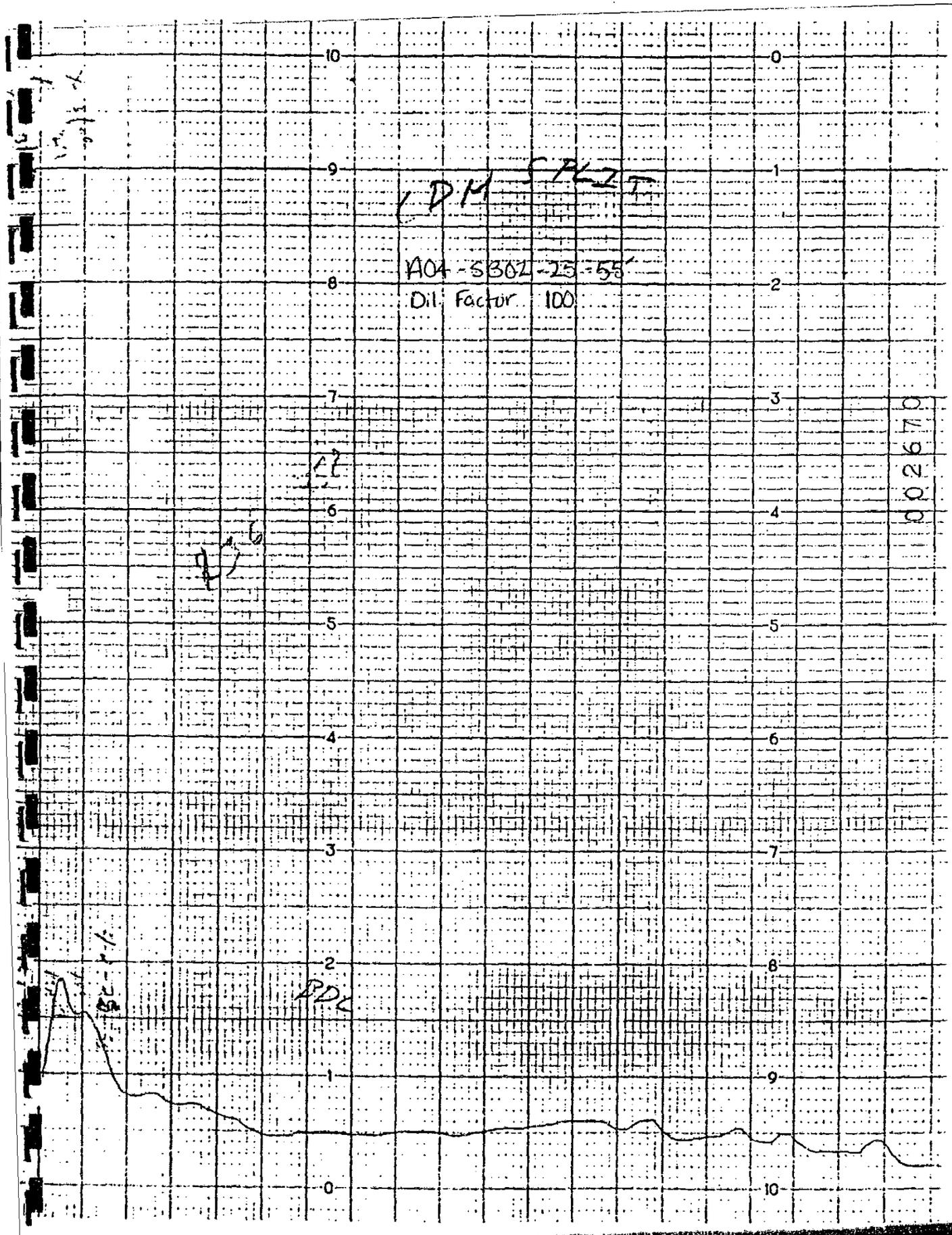

CPM SPLIT
A04-SB02-03-6
Dil Factor 200
0
1
2
3
4
5
6
7
8
9
10
10
9
8
7
6
5
4
3
2
1
0

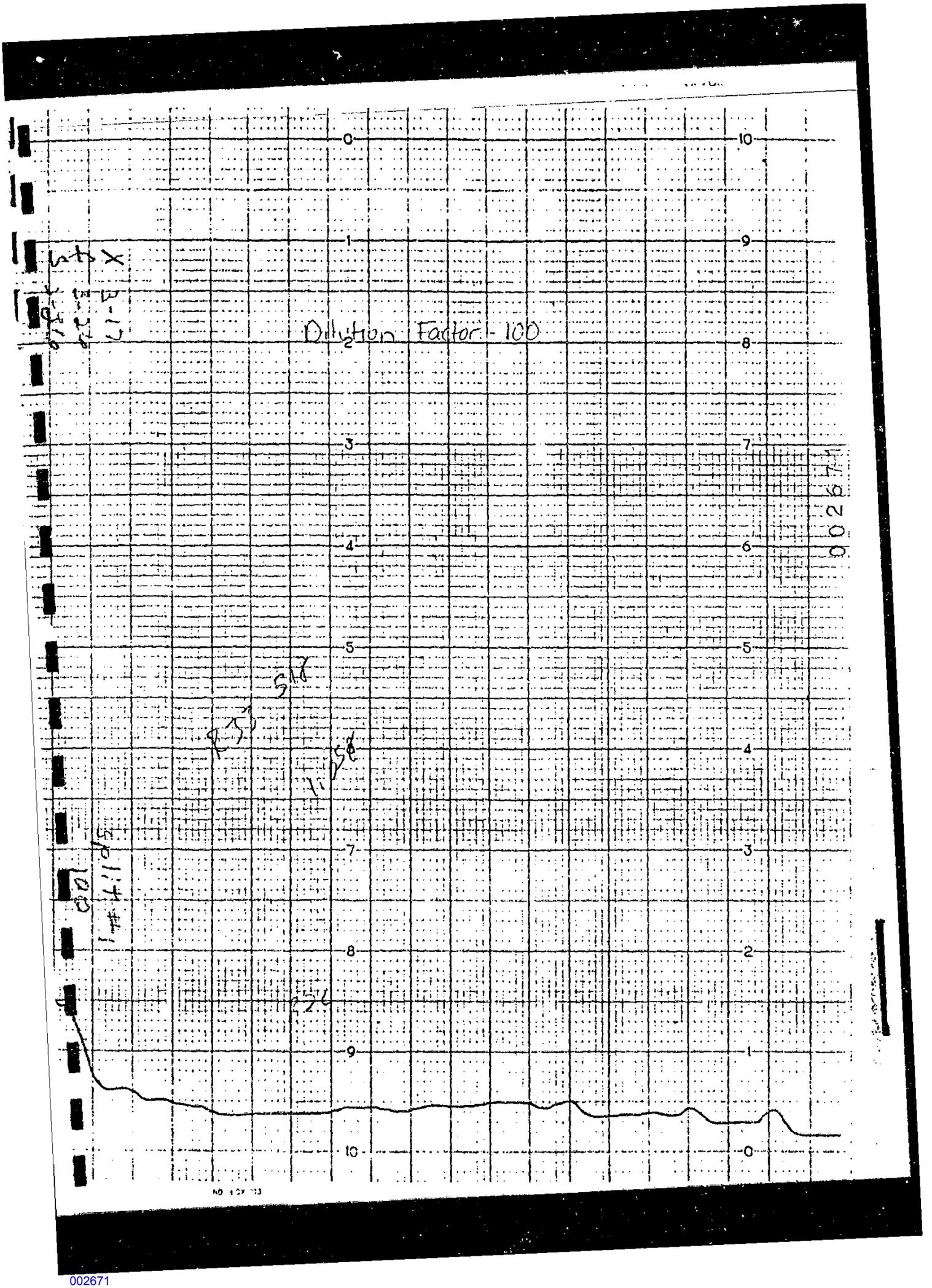


002667

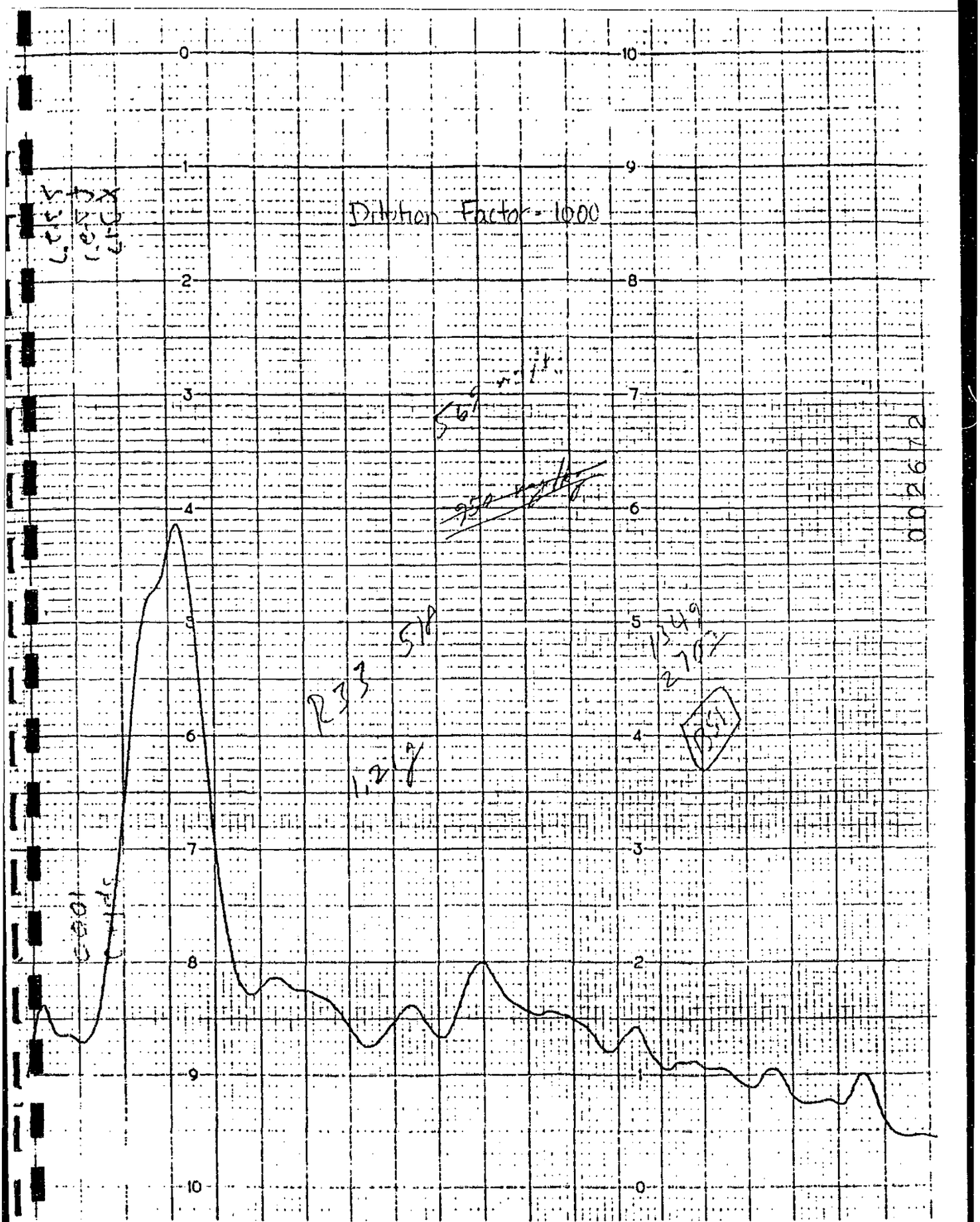

CDM
A04-SB02-10 25.5'
Dil. Factor 300

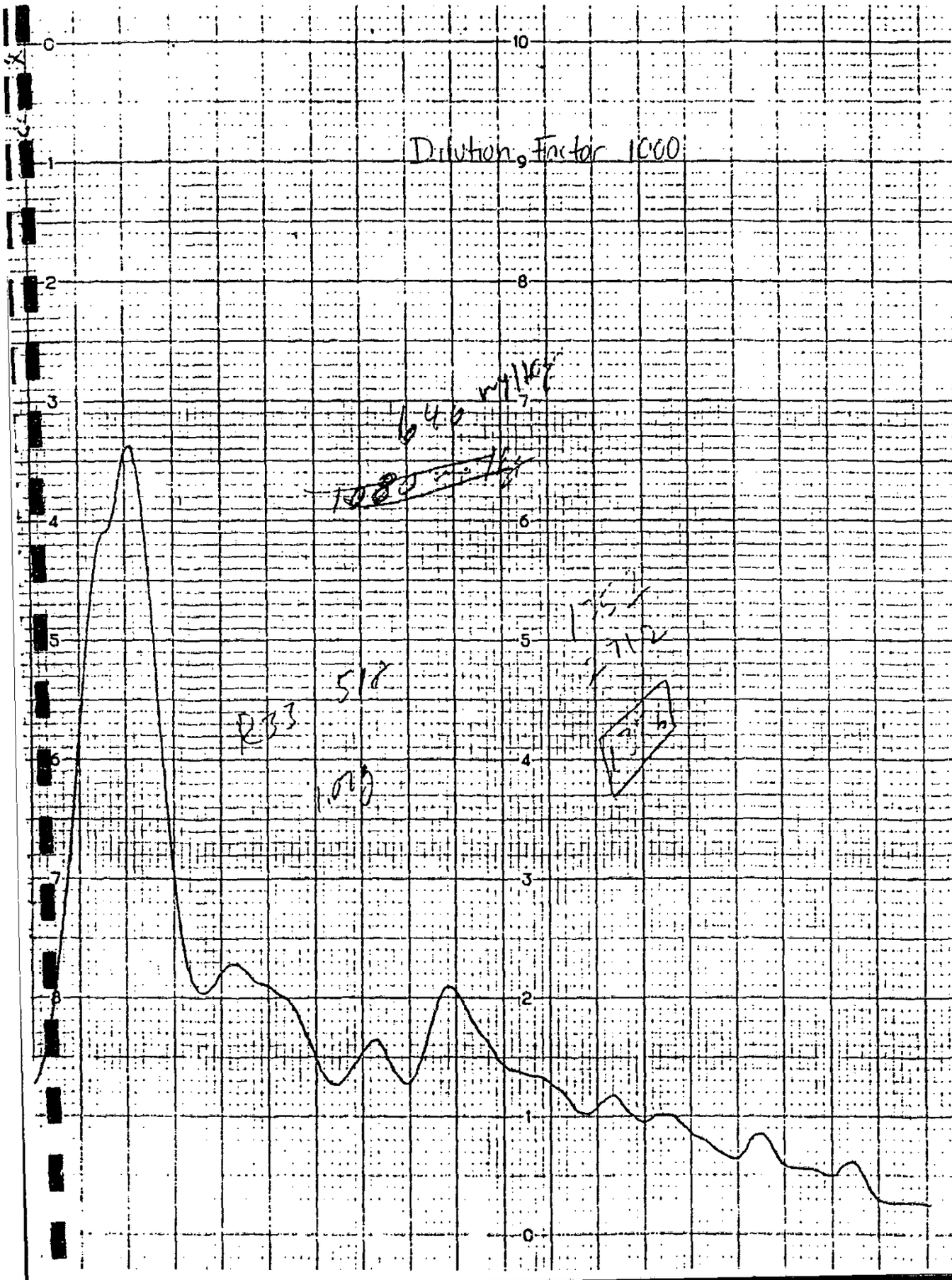

CDM SPLIT
A04-SB07-18-A.5
Dil Factor 100
BPL


CDM SALT
A04-5302-25-55
Dil Factor 100
002670

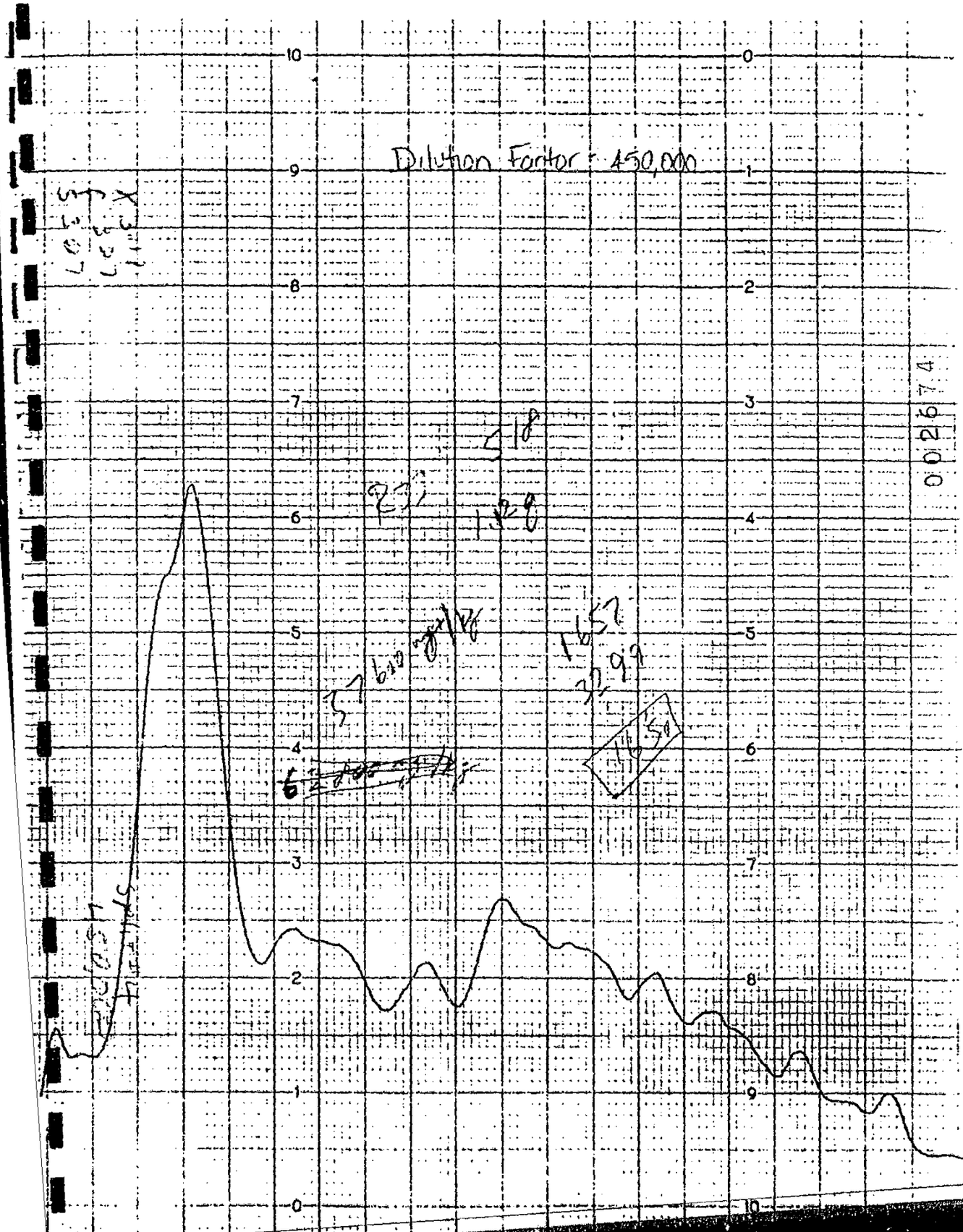


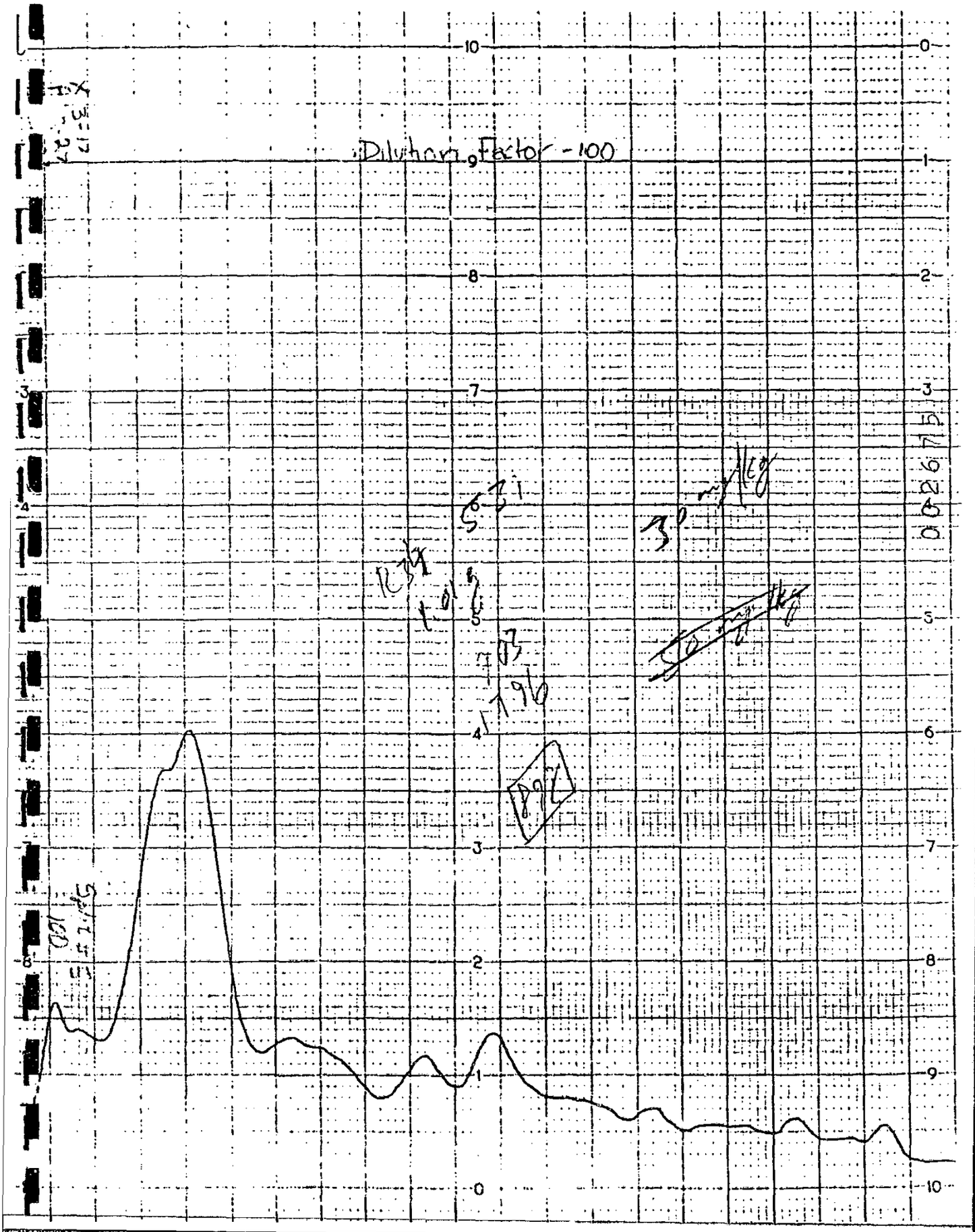
002671


Dilution Factor - 1000


Dilution Factor 1000
640 mg/kg
1080 mg/kg
518
R33
1.08
1352
712
1376
0
1
2
3
4
5
6
7
8
9
10

002673


Dilution Factor = 450,000
002674


Dilution Factor - 100

APPENDIX E

SURROGATE SOIL TEST RESULTS

002676

COPPERS - SOUTH CAVALCADE SITE

Soil Surrogate Test Results (ppm) (1),(2)

Sample No.	Sample Depth -ft-	Sample Date	Metals Test Date	Water Content, percent (3)	Arsenic (DL=.04) Conc.	Arsenic std. dev.	Chromium (DL=.03) Conc.	Chromium std. dev.	Copper (DL=.5) Conc.	Copper std dev.	Lead (DL=10.0) Conc.	Lead std. dev.	Zinc (DL=30) Conc.	Zinc std. dev.	Total Aromatic Hydrocarbons Conc.	Total Aromatic Hydrocarbons DL
A04-SB02-03	8	3-6-86	3-26-86	19.3	BDL	49	BDL	204	BDL	42	BDL	162	BDL	56	2023	32
A04-SB02-07	13.5	3-6-86	3-26-86	21.5	[illegible]	50	BDL	204	BDL	42	BDL	162	BDL	56	4918	54
A04-SB02-10	25.5	3-6-86	3-26-86	26.0	BDL	[illegible]	BDL	204	BDL	42	124	162	BDL	56	186	5
A04-SB02-18	41.5	3-6-86	3-26-86	17.2	BDL	52	BDL	204	BDL	42	144	162	BDL	56	BDL	0.18
A04-SB02-25	55	3-6-86	3-26-86	27.4	BDL	[illegible]	BDL	204	BDL	42	BDL	162	BDL	56	BDL	0.18
COM SPLIT 1		3-5-86	3-19-86	19.5	BDL	54	BDL	204	BDL	42	213	162	BDL	56	BDL	0.18
COM SPLIT 2		3-5-86	3-19-86	22.4	21.2	51	BDL	204	BDL	42	87	162	54	56	569	18
COM SPLIT 3		3-6-86	3-19-86	24.5	145	50	BDL	204	BDL	42	133	162	40	56	646	18
COM SPLIT 4		3-6-86	3-19-86	27.3	182	50	BDL	204	BDL	42	237	162	53	56	37600	8100
COM SPLIT 5		3-6-86	3-19-86	30.4	BDL	[illegible]	BDL	204	BDL	42	BDL	162	BDL	56	30	180

(1) Total weight basis. (2) BDL denotes below detection limits. (3) Dry weight basis. (4) DL denotes detection limits.