March 30, 1972

Mr. James R. Gervan
State Supervisor of Art & Music
Education
Department of Public Instruction
Dover, Delaware 19901

Dear Mr. Gervan:

The sampling results obtained from the preliminary survey of the atmosphere adjacent to kilns during the firing of ceramic ware are summarized in the enclosed table. The atmospheric levels of lead are expressed in micrograms (μg) of lead per cubic meter of air and appear in the extreme right column. Three samples were obtained at John Dickinson High School, three samples at William Penn High School, and one sample at the Faulk Road Elementary School. All of the atmospheric levels are below the accepted occupational exposure level of 200 μg Pb/m^3 of air, which is the standard under the Occupational Safety and Health Act of 1970. This level is accepted as the occupational exposure level at which an employee can be exposed for 8 hours per day for a lifetime with no adverse health effects.

The sample identified as sample no. 1 represents a very high value and if it is indeed representative of the atmosphere, the kiln should be equipped with a hood and exhausted into the outside atmosphere. However, sample no. 3 was obtained at the same sample location as sample no. 1, but approximately one hour later, and with the same sampler. In view of the results of sample no. 3 and the low levels represented by the other samples, I tend to believe that sample no. 1 was contaminated and is not a representative sample. Contamination sometimes does occur, and is significant because of the relatively low levels of lead in the samples. However, I do not know positively that the sample was contaminated and therefore cannot overlook this result. The other atmospheric samples are relatively low and do not represent any significant exposure. Samples nos. 2 and 5, which were obtained with the small Wilson Casella personal sampler, operating at a much lower flow rate, are not as reliable as the samples obtained with Gelman pump (samples # 1, 3, 4, 6, and 7), which samples at a much higher flow rate.

As you know, this was a cursory study to determine whether the atmospheric levels of lead in the vicinity of kilns were high or low, and was not designed to provide details of kiln emissions. Unfortunately, because of the high value of sample no. 1, there can be no definite conclusion without additional information. We plan to do additional sampling around kilns of a similar type here in the New York area, in an effort to obtain conclusive information. This sampling cannot be fit into my schedule before approximately mid April. I will forward the results to you as they become available.

Any possibility of airborne contamination could be completely eliminated by providing each kiln with an exhaust hood and adequate exhaust system. In order to determine whether the personnel working continuously in the kiln area have excessive absorption of lead, analysis of blood for lead is recommended. The normal concentration of lead in blood is in the range of 15-20 µg of lead per 100 grams of whole blood. These values are found in the general population and are representative of personnel with no occupational exposure. Blood lead concentrations of 80 µg/100 gm are considered safe for workmen engaged in the lead trades.

If you desire to have blood samples analyzed for lead, I would be happy to recommend qualified laboratories to do the analyses. Also, perhaps Mrs. Evans' physician would like to consult with physicians who have had much experience in dealing with occupational lead exposures. I would recommend Dr. Lloyd Tepper, Department of Environmental Health, University of Cincinnati, Kettering Laboratory, Cincinnati, Ohio 45219, telephone 513-872-5704, as a highly qualified medical expert in the lead area.

I am enclosing a copy of the repring, "Industrial Lead Poisoning" by Dr. Robert A. Kahoe, which provides much information on occupational exposures to lead.

Thank you very much for your assistance, and if we can provide additional information, please do not hesitate to contact us.

Sincerely,

D. R. Lynam
Assistant Director,
Environmental Health

Enc.

cc: J. F. Cole
J. F. Smith

lp

Summary of Results

Sample Number	School	Date and Time of Sampling Period	Description of Kiln	Kiln Temperature (Degrees Fahrenheit)	Sampler Location	Type of Sampler	Concentration of Lead (µg/m³)
1	John Dickinson High School	3-7-72, 2:12 to 3:12 P.m.	Hexagonal Dey Stacking (3 stacks) L & L Econo Kiln model K-230 32 inches wide 32" High	1250 at 2:30 P.m. 1325 at 2:40 P.m. 1500 at 3:09 P.m.	1½ ~~feet~~ directly above Top of Kiln	Gelman Pump and gloss fibre filter, operating at 2 L pm	134.46
2	John Dickinson High School	3-7-72, 2:13 to 4:17 P.m.	Same as Sample # 1	Same as Sample # 1 & Sample # 3	Same as Sample #1	Wilson Casella Personal Sampler, gloss fibre filter operating at 2LPm	29.03
3	John Dickinson High School	3-7-72, 3:16 to 4:17 P.m.	Same as #1	1500 at 3:20 1650 at 3:50 1700 at 4:12	Same as Sample #1	Same as Sample #1	1.86
4	William Penn High School	3-8-72, 9:43 to 10:43 A.m.	Fine Art Electric Kiln, Type FA88 6' high, Front loading	1150 at 9:50 A.m. 1350 at 10:35	7' above floor, 1½' horizontally in front of Kiln	Same as Sample #1	2.80
5	William Penn High School	3-8-72, 9:44 to 11:59 A.m.	Same as sample # 4	Same as Samples # 4 and # 6	4' horizontally from front of Kiln, at 6' height	Same as Sample # 2	8.52
6	William Penn High School	3-8-72, 10:45 A.m. to 12:14 P.m.	Same as Sample # 4	1550 at 11:21 1750 at 12:14	Same as Sample # 4	Same as Sample #1	2.25
7	Fawlr Road Elementary	3-8-72 1:54 P.m to 3:24 P.m.	AMACO High Fire Type High Fire #9s Top Loading 28" x 28" x 24"	750 at 1:54 850 at 2:35 875 at 3:00 900 at 3:20	1½' directly above top of Kiln	Same as Sample # 1	1.26

SUMMARY OF RESULTS

Sample Number	School	Date and Time of Sampling Period	Description of Kiln	Kiln Temperature (Degrees Fahrenheit)	Sampler Location	Type of Sampler	Atmospheric Levels of Lead ($\mu g/m^3$)
1	John Dickinson High School	3-7-72 2:12 to 3:12 P. M.	Hexagonal dry stacking (3 stacks) L & L Econo Kiln model K-230 32 inches wide 32 inches high	1250 at 2:30 P. M. 1325 at 2:40 P. M. 1500 at 3:09 P. M.	1-1/2 feet directly above top of kiln	Gelman pump and glass fiber filter, operating at 22 LPM	134.46
2	John Dickinson High School	3-7-72 2:13 to 4:17 P. M.	Same as Sample # 1	Same as Sample # 1 & Sample # 3	Same as Sample # 1	Wilson Casella personal sampler, glass fiber filter operating at 2 LPM	29.03
3	John Dickinson High School	3-7-72 3:16 to 4:17 P. M.	Same as Sample # 1	1500 at 3:20 P. M. 1650 at 3:50 P. M. 1700 at 4:12 P. M.	Same as Sample # 1	Same as Sample # 1	1.86
4	William Penn High School	3-8-72 9:45 to 10:43 A. M.	Fine art electric kiln Type FA88, 6 inches high, front loading	1150 at 9:50 A. M. 1350 at 10:35 A. M.	7 feet above floor, 1-1/2' horizontially in front of kiln	Same as Sample # 1	2.80
5	William Penn High School	3-8-72 9:44 to 11:59 A. M.	Same as Sample # 4	Same as Samples # 4 and # 6	4 feet horizontially from front of kiln, at 6 feet height	Same as Sample # 2	8.52
6	William Penn High School	3-8-72 10:45 A. M. to 12:14 P. M.	Same as Sample # 4	1550 at 11:21 A. M. 1750 at 12:14 P. M.	Same as Sample # 4	Same as Sample # 1	2.25
7	Faulk Road Elementary	3-8-72 1:54 to 3:24 P. M.	AMACO High Fire, Type High Fire # 95, top loading 28" x 28" x 24"	750 at 1:54 P. M. 850 at 2:35 P. M. 875 at 3:00 P. M. 900 at 3:20 P. M.	1-1/2 feet directly above top of kiln	Same as Sample # 1	1.26

SAmple #1 - 22 lpm / 60 min
1320 liters ≈ 1.32 meters^3

$\frac{177.5 \text{ wgs}}{1.32 \text{ meters}^3} \approx 134.46 \text{ wg/m}^3$

Sample # 2 - 124 minutes
2 lpm or 4 lpm
248 liters = .248 meters^3 $\frac{7.2}{.248} \approx 29.03 \text{ wg/m}^3$

Sample #3 - 22 lpm / 61 min
22
132
134.2 ≈ 1.342 meters $\frac{2.5 \text{ wgs}}{1.342 \text{ meters}^3} \approx 1.86 \text{ wg/m}^3$

Sample # 4 - 22 lpm
60
1320 liters = 1.32 m^3 $\frac{3.7}{1.32} \approx 2.80 \text{ wg/m}^3$

Sample # 5 - 135 min.
2
270 liters = .270 $\frac{2.3}{.270} = 8.52 \text{ wg/m}^3$

Sample # 6 - 22 lpm
89 min
198
176
1958 liters = 1.958 $\frac{4.4}{1.958 \text{ liters}} = 2.247 \text{ wg/m}^3$

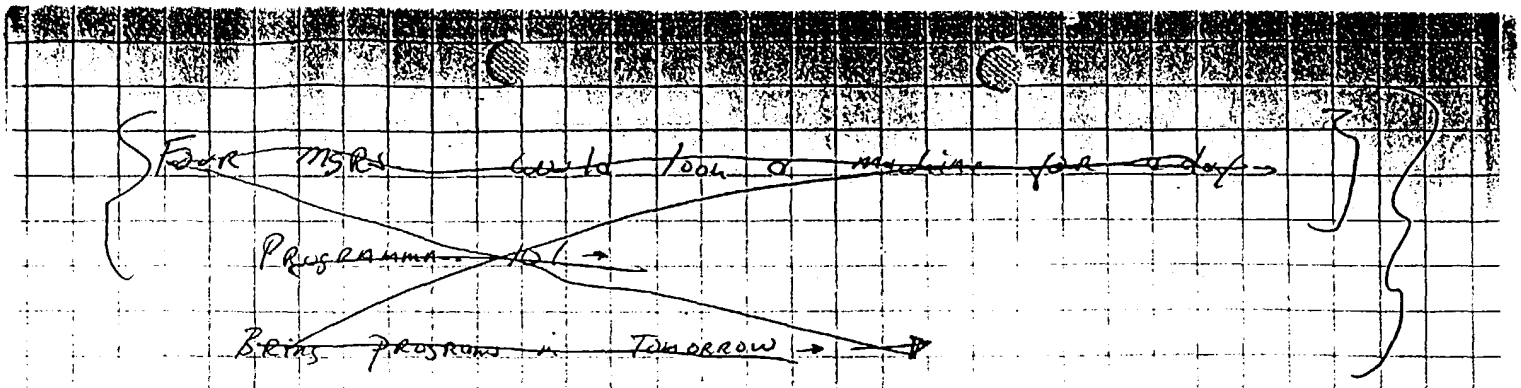
LIA-76947

Sample # 7 - 3.24 2L

1:54 90 min.

1:30 1980 liters = 1.98 m³ 2.548 / 1.98 = 1.26 kg/m³

LIA-76948



Russell FRANK - FERRO

not around hobby kilns -

around Reduction equipment -

dept. store - characteristic sweet taste →
hot plate Using Jewelers enamel

both a sweet taste & Selenium

of how a hobbyist can be tricked into an unusual situation -

Russell FRANK

Pot smelters. 55 sal. barrell as high as
All are gas fired → non circulating inert furnaces

Greatest exposure during
moisture expanded into a vapor
have a drying action - have a pressure

Weld to a box type furnace Without circulating fan -

work to redesign that condition exists →

ARe getting material out

John MARQUIS → of Penco -

did some WORK in regarding to circulation air in kiln - & atmosphere

Where/present in

Selenium, Cadmium

→ freshly Recreated CRYstalline metal ←

Reducing in a FURNACE:

Oxidize, Reduce, Condenses when it pours out the end.

how much lead - etc. was in the slags

One major customer - S. Powell WARD. Repackaged

Real people will smelt a lot of their own materials.

Natural CERAMICS hobby manufacturers -

dead

ORganics +

colors applied as ORGANIC Resin & Resins burns out & leaves oxide on surface -

Encourage to do on →

identify & families } slags →

Possible contamination

① 177.5 ugs. Joh. | Possible Contamination

② 7.2 ugs.

③ 2.5 ugs.

④ 3.7 ✓ 1

⑤ 2.3 ← 2½

⑥ 4.4 ✓ 1½

⑦ 2.5 ugs. P6

22 LPM
60
1320 liters

$\frac{177.5 \text{ ug.}}{1320 \text{ liters}} = .1 \text{ ug/liter}$

liters = 0.1 mg/m³

2020

LIA-76951

Casella – hooked up with an y flow meters of trio → at 2LPM – (top mark) 4LPM at a setting of two on Casella meter →

Adj. Flow meter to 2 LPM & brush ball → 1.95 & 2.1 ball on Casella scale → Probably at 4 LPM Rather than 2 → flow meters in series there →

Calibrate with wet test meter - the flow meters -

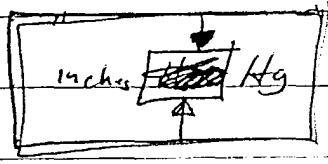
not went over with Bill -

need curves →

5 - 25 LPM scale -

how accurate reading of bell

Rotameter reading	→	Wet Meter Result.
5 LPM	→	6.55 LPM
10		11.80 LPM
15		17.80 LPM
18		20.6 LPM



wet Tst meter between flow meter & pump

fitter - wet tst meter Pump →

SAMPLING DATA

Date: 3-8-82

Weather Conditions: _____ Time: 1:

~~with~~ Faulk Road Elementary School / Name: _____

Alfred I du Pont School District

Location	Gauge Reading (~~Inches H2O~~)	Gauge Type	Time	Comments
Sample ~~#1~~ Gelman Pump	20 LPM basis 19 LPM – 2:35 19 LPM – 3:00 19 LPM – 3:20 Sampler located at 3' left of Center	1' above top of	Kiln begin. 1:54 P.M. end 3:24 P.M.	750° Kiln Temp - at 1:54 850° at 2:35 850 at 2:50 875° at 3:00 900° at 3:20 5" Hg - Vacuum Pump - basis
Changed	position of sampler at 2:11 Sampler placed 1½' above top of Kiln.			5" Hg. . . . . 2:35 5" " . . . 3:00
	Kiln - Top 28 x 28 x 24" High.	Loading		~~Thermometer~~ Pyrometer – was stuck into viewing port, so there was not a tight seal
Type Kiln: AmAco High Fire HF 95 Type High Fire #95 Serial No. 95155				
	208 volts 28 Amps.			

LIA-76953

SAMPLING Data

Location: John Dickerson H.S. Date: MARCH 7 1979

Weather Conditions: 3 stacks Time: 2:00 P.M.

LARBe Hexagonal DRY Stacking groove at the Name:

L & L Econo Kiln model K-230 220 volts 41.7 Amps

Location	L&L manuf. Co. Test a oats Reading Gauge Reading (Inches H_2O)	Gauge Reading	Time	Comments
Sample #1 CO	Gelman Pump - (ESB) Positioned at 1½ feet directly above TOP of Kiln	begin 20 LPM end - 19 LPM	begin 2:12 P.m. End 3:12	5" Vaccuum on Pump Gauge Kiln Temp → 1250 °F - 2:30 1325° F at 2:40 1500° F at 3:09
Sample #2	Wilson Casella positioned at app. 1½ feet above Top of Kiln.		began. 1522.33 minutes - app. 2:13 P.m. ball at Lower Line on Rotameter 1589.13 min at 3:22 end; 1644.27 at 4:17 P.m.	
Sample #3	Gelman Pump (ESB) same position as #1	begin-20 LPM	begin 3:16 P.m. end 4:17	5" Vacuum on pump Gauge Kiln Temp- 1500° F at 3:20 1650 at 3:50 1700 at 4:12
Kiln; 30 inches wide at Top 32 high			outside	dimensions
AMACO Indianapolis American Art Clay Co. Inc				

LIA-76954

American Art Clay Co. SAMPLING Data

Indianapolis Ind. 46222 Date: 3-8-1972

Weather Conditions: William Penn High School Time: 9:30

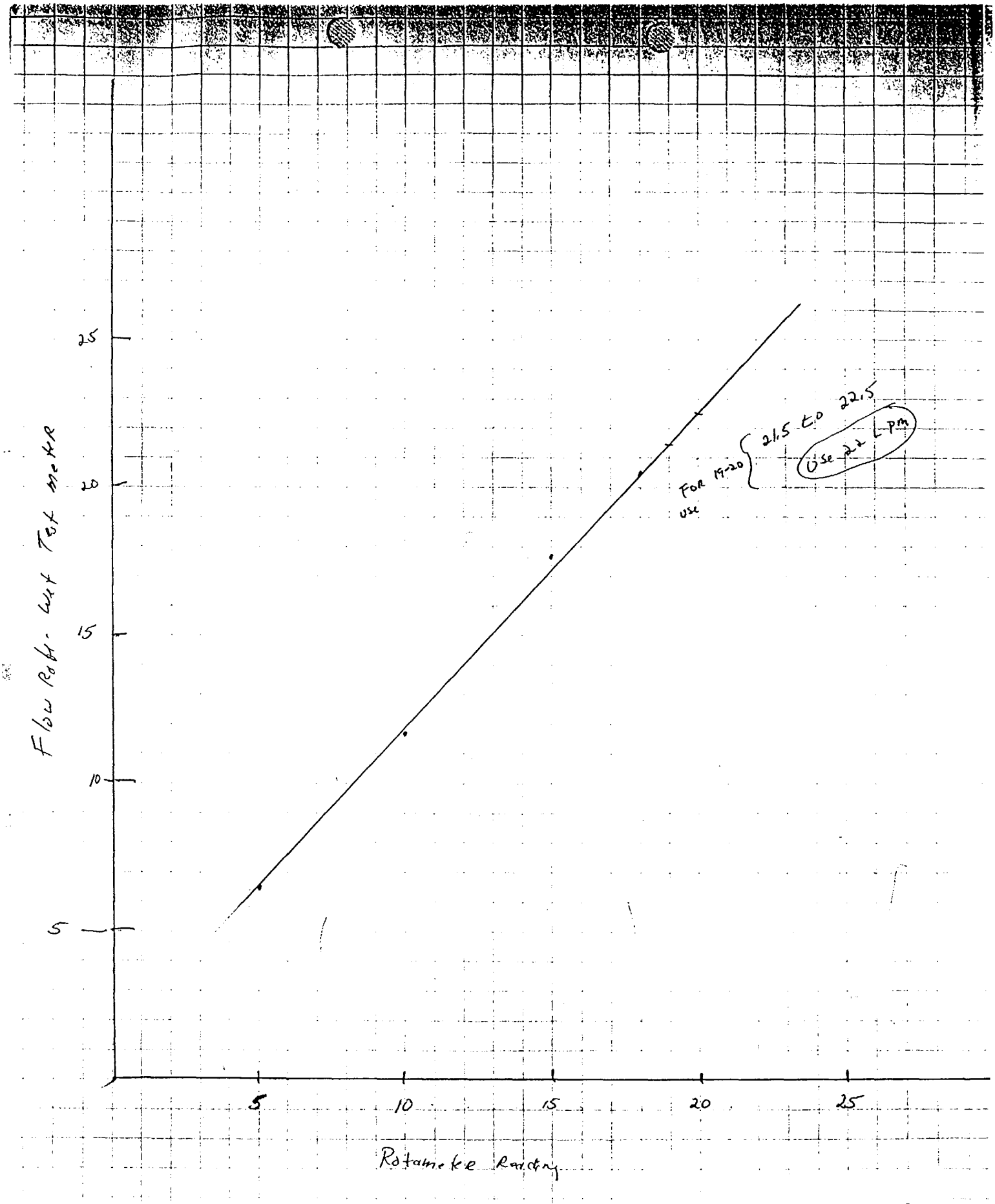
Chuck Newcastle — Det. Gunning Bedford School Teacher District Alarme

Fine ART Electric Kiln, An Amaco Product Type FA88 Serial No. 88A92

28.7 Amperes 208 Volts

Location	Gauge Reading (Inches H_2O)	Gauge Type	Time	Comments
Sampler #4 Positioned	begin at 20 LPM 20 LPM - at 10:03 20 LPM - at 10:33 at 7' above floor Level - 1½' in front of Kiln - 6' High Kiln		begin 9:43 end at 10:43 at 19 LPM	4½" Hg. on Gelman Pump. Kiln Temp - 1150° - 9:50 1350° - 10:35
sampler #5	Wilson Personal Gasella Sampler.		begin 1644.29 min. - 9:44 1663.30 - 10:03 1694.07 - 10:34 1707.93 - 10:48 1779.25 — 12:10	at lower line on Rotameter 124 135 min 136 2:22 12:10 146 battery had just about stopped
Sample #6	Gelman begin at Same position - @ #4. 19.0 LPM at 11:21 19.0 - end at 12:14 -	19.5 LPM.	begin 10:45	4" Hg. on Gelman Pump 1550° - 11:21 1750 - 12:14

LIA-76955


Flow Rate - Wet Test Meter
25
20
15
10
5
5
10
15
20
25
Rotameter Reading
For 19-20 use
21.5 to 22.5
Use 22 LPM

LIA-76956