COMBUSTION ENGINEERING

April 7, 1989

Leland C. Rouse
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety
U. S. Nuclear Regulatory Commission
Washington, DC 20555

REF: Docket 70-36
License #SNM-33

SUBJECT: SPENT LIMESTONE RESULTS

Dear Mr. Rouse:

Enclosed is a report on the spent limestone monitoring program required by Condition #16 of SMN-33. The monitoring was conducted to determine the radioactive content of spend limestone and to assess any possible environmental effects of using spent limestone as fill material in the on-site unrestricted area. Information has previously been submitted on uranium content and isotopic composition, activity in dust from tumbling contaminated limestone, Tc-99 activity levels and solubility test results.

The sampling program results show that survey and release procedures started in 1979 are effective in that all spent limestone currently used as fill material is well below the 30 picocuries per gram limit for unrestricted release specified in Option 1 of the Branch Technical Position Paper on residual radioactivity levels. Pre-1979 spent limestone is only 50% of the Option 1 limit.

Therefore, we request approval of:

1. Unrestricted release of spent limestone currently in place as fill material (Pile A and C).
2. Disposition of the pre-1979 spent limestone (Pile B) as on-site unrestricted area fill material.
3. Establishment of current spent limestone survey methods as an approved procedure for releasing spent limestone as on-site unrestricted area fill material.

We will be glad to discuss the monitoring program results with your or your staff at your convenience.

Respectfully submitted,

J. A. Rode,
Plant Manager

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R-14

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APR 12 1989

SPENT LIMESTONE MONITORING

PROGRAM RESULTS

COMBUSTION ENGINEERING, INC.

HEMATITE PLANT

MATERIALS LICENSE #SNM-33

April, 1989

SPENT LIMESTONE MONITORING

PROGRAM RESULTS

1.0 Introduction

The Combustion Engineering Hematite Plant uses limestone rock chips in dry scrubbers to remove hydrogen fluoride from the offgas stream of the UF_6 to UO_2 conversion process. The limestone chips are partially converted to calcium fluoride in the scrubbers, and are referred to as "spent limestone" after removal from the scrubbers. Spent limestone is monitored with an alpha survey meter upon removal, and is released for use as on-site fill material if no alpha activity above background levels are detected. Spent limestone with detectable activity, but not greater than 1000 dpm/100 cm^2, was quarantined in an intermediate storage pile at the southeast corner of Building 255. If the activity level exceeded 1000 dpm/100cm^2, the limestone was packaged for shipment to licensed burial.

2.0 Discussion

The above spent limestone handling procedure was initiated in September, 1979, when NRC permission was obtained to use spent limestone with no detectable alpha activity and less than 5x background level beta activity as on-site fill material. A second set of porous metal filters was installed in the offgas line in 1979 to provide backup in case of failure of the primary filters, essentially eliminating incidents causing significant limestone contamination. This material has been used as fill at two locations; Pile A is approximately 100 yards east of the fenced manufacturing area, and Pile C is immediately north of the site pond.

Prior to September, 1979, all spent limestone with contamination levels less than 1000 dpm/100 cm^2 was accumulated in a pile located in the southeast corner of the fenced area (separated from the intermediate storage area for quarantined limestone by a roadway). The majority of the pre-1979 limestone had no detectable alpha contamination. The pre-1979 spent limestone is identified as Pile B.

Locations of the three spent limestone piles are shown on a site map in Figure I. The quarantined limestone has been placed in 55 gallon drums for storage pending further analyses to determine the appropriate method of disposition, and is not included in this report.

3.0 Monitoring Program

Pursuant to condition #16 of License SNM-33, a monitoring program has been conducted to determine the radioactive content of the spent limestone piles and to assess possible environmental effects (if any) from using spent limestone as fill material in the on-site unrestricted area. The monitoring program consisted of (1) sampling and analysis to determine activity levels and distribution within each pile, (2) soil samples at the downhill edge of the fill areas to measure possible soil contamination by the fill material, and (3) continuous air sampling above each pile to measure possible air contamination.

3.1 Determination of Activity Levels and Distribution

3.1.1 Sampling

Sampling locations were determined by superimposing a 5′ x 5′ horizontal grid pattern on to the surface of each of the three piles. Each horizontal row was identified by number and each vertical row identified by letter. Sampling grid layouts are shown in Figures 2, 3 and 4. A representative sample was obtained from each grid cell by taking a sample at five evenly spaced locations, as shown in Figure 5. The individual samples from each cell were combined into double poly bags and identified by pile and cell location within the pile. The volume of each composite sample was approximately 2 liters.

After completion of the grid sampling, core samples were obtained by digging into each pile at the point of maximum thickness and taking a sample at 1 foot depth intervals. Locations of the core samples are shown in Figure 6. The core samples were also placed in poly bags and identified.

3.1.2 Sample Preparation

Each composite and core sample was spread out on a 32" x 40" poly bag and placed in the sun to dry in preparation for milling. Caution was used while drying the samples to avoid the possibility of cross-contamination. The drying area was the roadway along the south side of the wood bard, approximately 100 yards outside the fenced manufacturing area. After drying, each sample was placed back into it's original poly bag and placed in 55 gallon drum storage. Each sample was thoroughly mixed in the drying process.

Milling of the samples was accomplished by using a micropulverizer which was purchased new for this purpose. As each sample was milled, the product was collected in a clean vacuum bag. The milled product was a homogeneous fine powder. A 50 gram sample was removed for analysis from each vacuum bag.

3.1.3 Sample Analysis

A 0.5 gram sample was weighed into a metal planchet from each 50 gram sample. The sample was then counted using a Tennelec low level gas proportional counting system. Results were calculated using an empirical self-absorption curve which corrected for the change in counting efficiency caused by the sample mass. The correction factor for alpha absorption in a 0.5 gram sample distributed evenly on the bottom of a metal planchet is 4.45. This factor was verified by comparative analysis with three other laboratories.

Results of these analyses are provided in Table 1. Contamination levels, in picocuries per gram, are shown in the same geometrical layout as the sampling grid for each pile. Average contamination levels were:

Pile A	8 pCi/gram
Pile B	15 pCi/gram
Pile C	7 pCi/gram

The above results were not corrected to subtract the contributions from naturally occurring radioisotopes which were in the fresh limestone prior to use in the dry scrubbers. Naturally occurring uranium levels in the fresh limestone have been measured in the 3 to 5 parts per million range.

3.2 Soil Sampling Downhill of Fill Areas

Quarterly soil samples have been collected at the downhill edge of the two fill areas to measure possible soil contamination resulting from the use of the spent limestone as fill material. Collection of these samples, beginning with the second quarter of 1985, has been incorporated into the routine site soil sampling program. The location north of the site pond is designated as Soil Station 11, and the location east of the fenced manufacturing area is designated as Soil Station 10. These samples are sent to a contractor laboratory for analysis. Results are shown in Table 2.

3.3 Air Sampling

Continuous high-volume air sampling was conducted to measure possible air contamination resulting from spent limestone surface dust suspension. Weekly samples were collected at the center of, and approximately 1 meter above, each of the three piles. The weekly samples were composited on a quarterly basis and analyzed by a contractor laboratory. Results are shown in Table 3. The lower limit of detection was less than 10^{-16} µCi/ml. Results include natural background from ambient dust loading and any contribution from normal operating stack emissions.

4.0 Conclusions

The sampling program to determine alpha activity levels of the post-1979 spent limestone demonstrates that this material is well below the 30 picocuries per gram limit for release for unrestricted use specified in the Branch technical position paper on residual radioactivity levels. The two piles of fill material averaged 7 and 8 pCi/g with no individual grid cells significantly above the limit. The pre-1979 pile, averaging 15 pCi/g, is only 50% of the limit, but is twice the level of the spent

limestone generated since the backup filters were installed in the UF_6 conversion offgas line. Thus, the combination of backup filters and present survey techniques result in spent limestone which has significantly lower contamination levels than that previously generated.

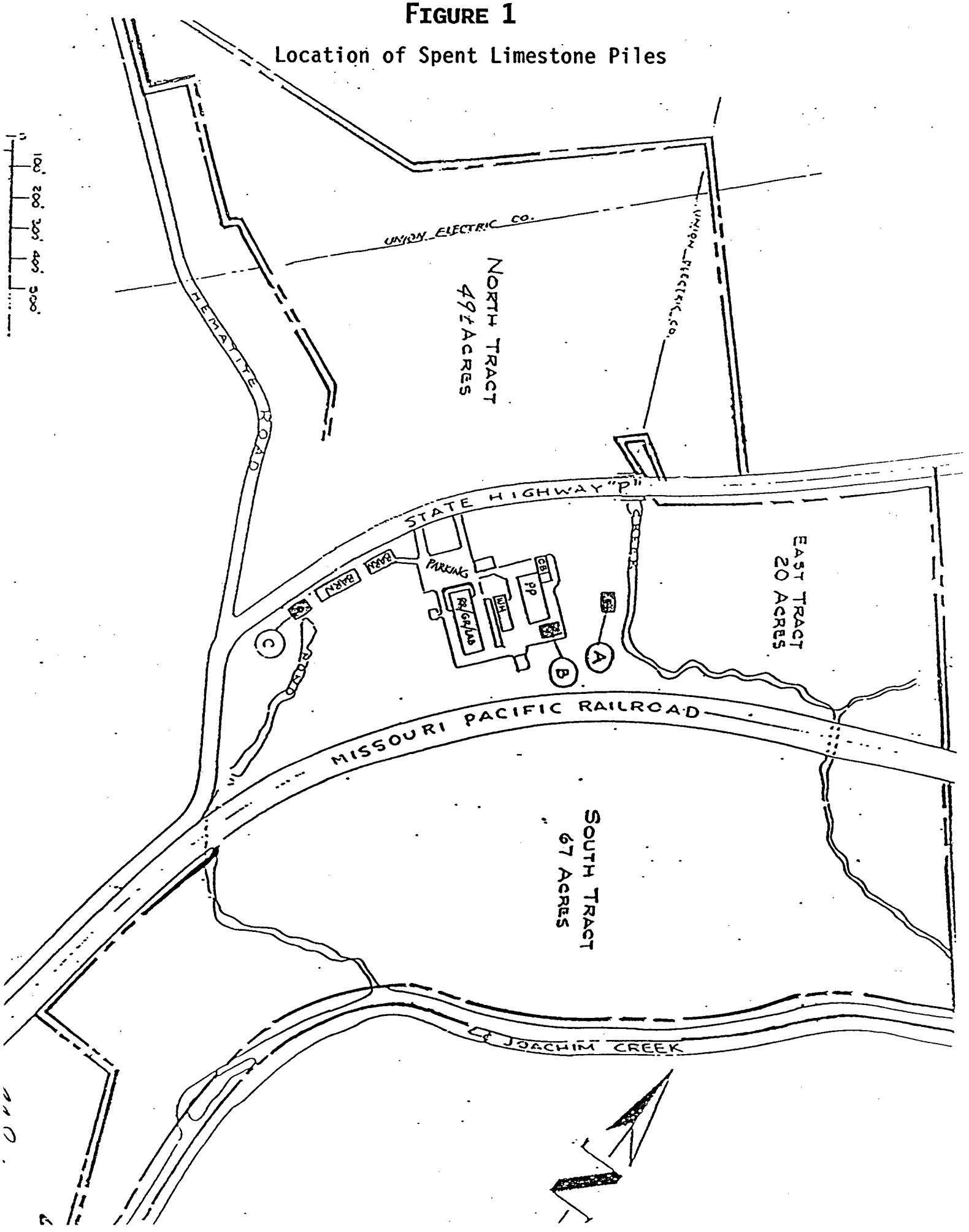
Soil sampling results from the contractor laboratory, although somewhat variable, show that no significant buildup is occurring in the soil downhill of the fill material areas.

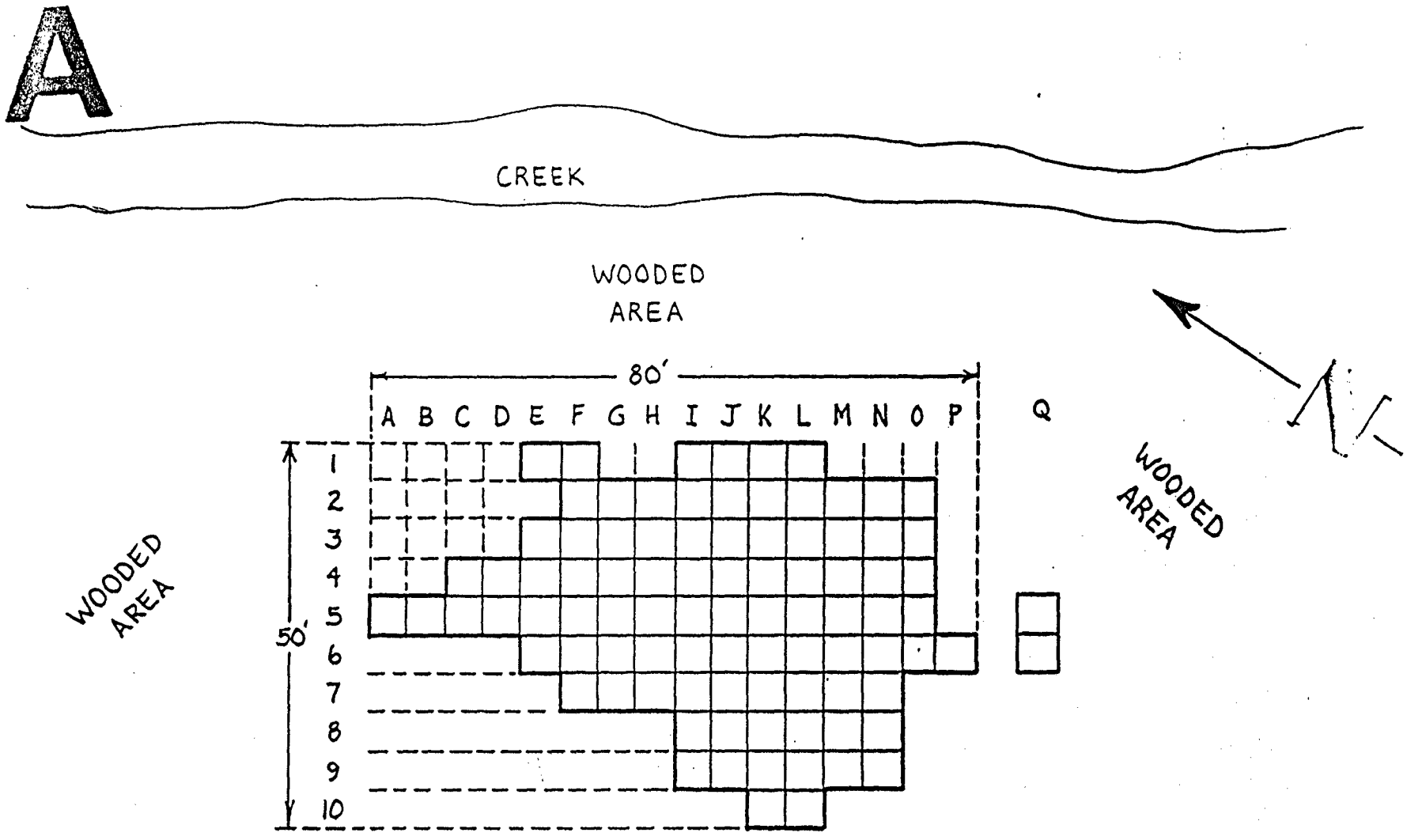
Air sampling results show that direct inhalation of suspended dust by an individual residing full time on the uncovered spent limestone fill material would result in a lung dose less than the 25 mrem annual limit. Atmospheric diffusion, covering the material with soil and less than full time residence, will further reduce the actual lung dose that would be received.

Based on the results of the above monitoring program of the spent limestone, it is our conclusion that release of this material under Option 1 of the Branch technical position paper would have no significant adverse environmental impact.

FIGURE 1

Location of Spent Limestone Piles

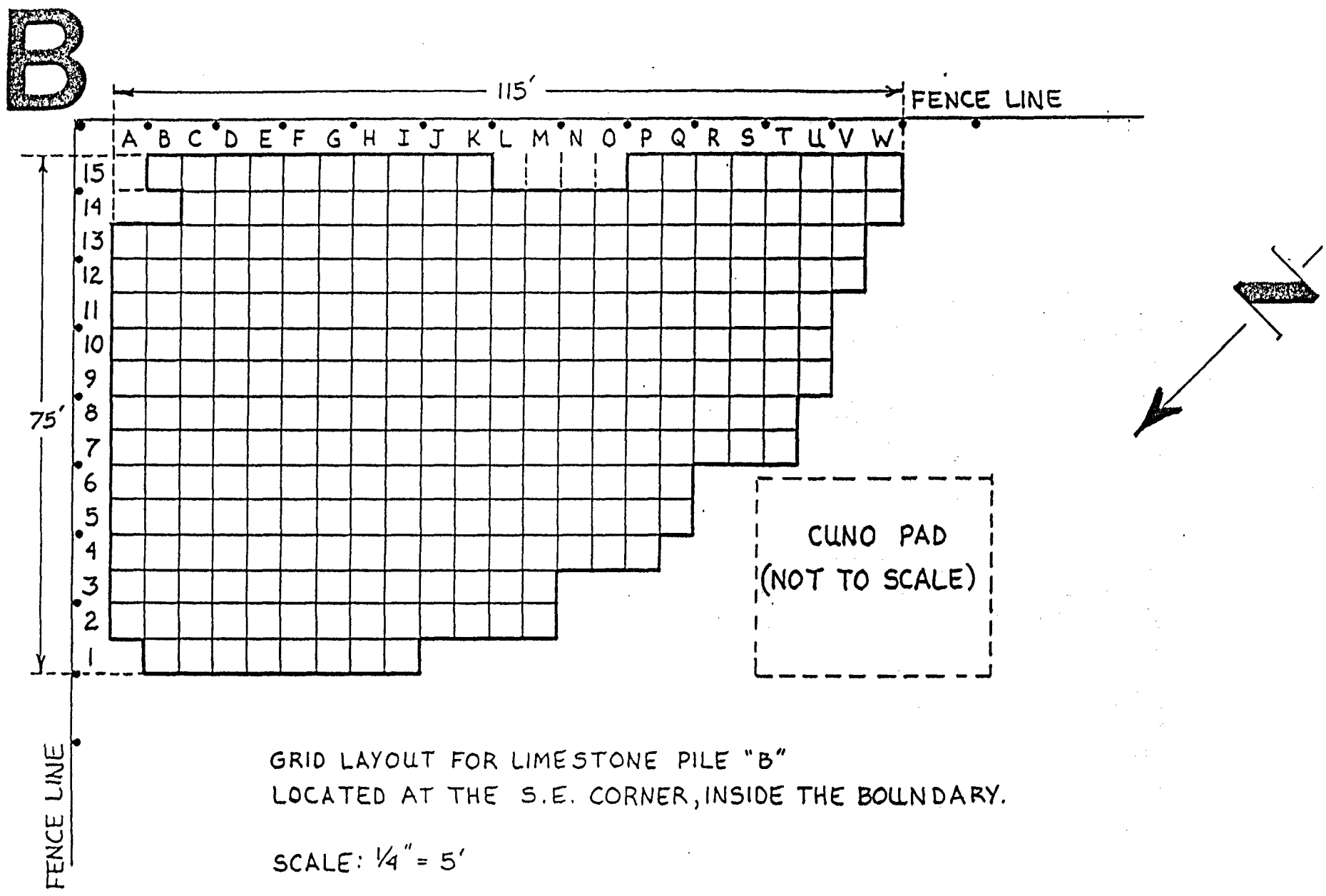




GRID LAYOUT FOR LIMESTONE PILE "A"
LOCATED APPROXIMATELY 100 YDS EAST OF
THE FENCED AREA.
SCALE: 1/4" = 5'

TOTAL COMPOSITES	90
TOTAL SAMPLES	450
TOTAL SQ. FT.	2250

FIGURE 2



GRID LAYOUT FOR LIMESTONE PILE "B"
LOCATED AT THE S.E. CORNER, INSIDE THE BOUNDARY.

SCALE: 1/4" = 5'

TOTAL COMPOSITES	271
TOTAL SAMPLES	1355
TOTAL SQ. FT.	6775

FIGURE 3

C

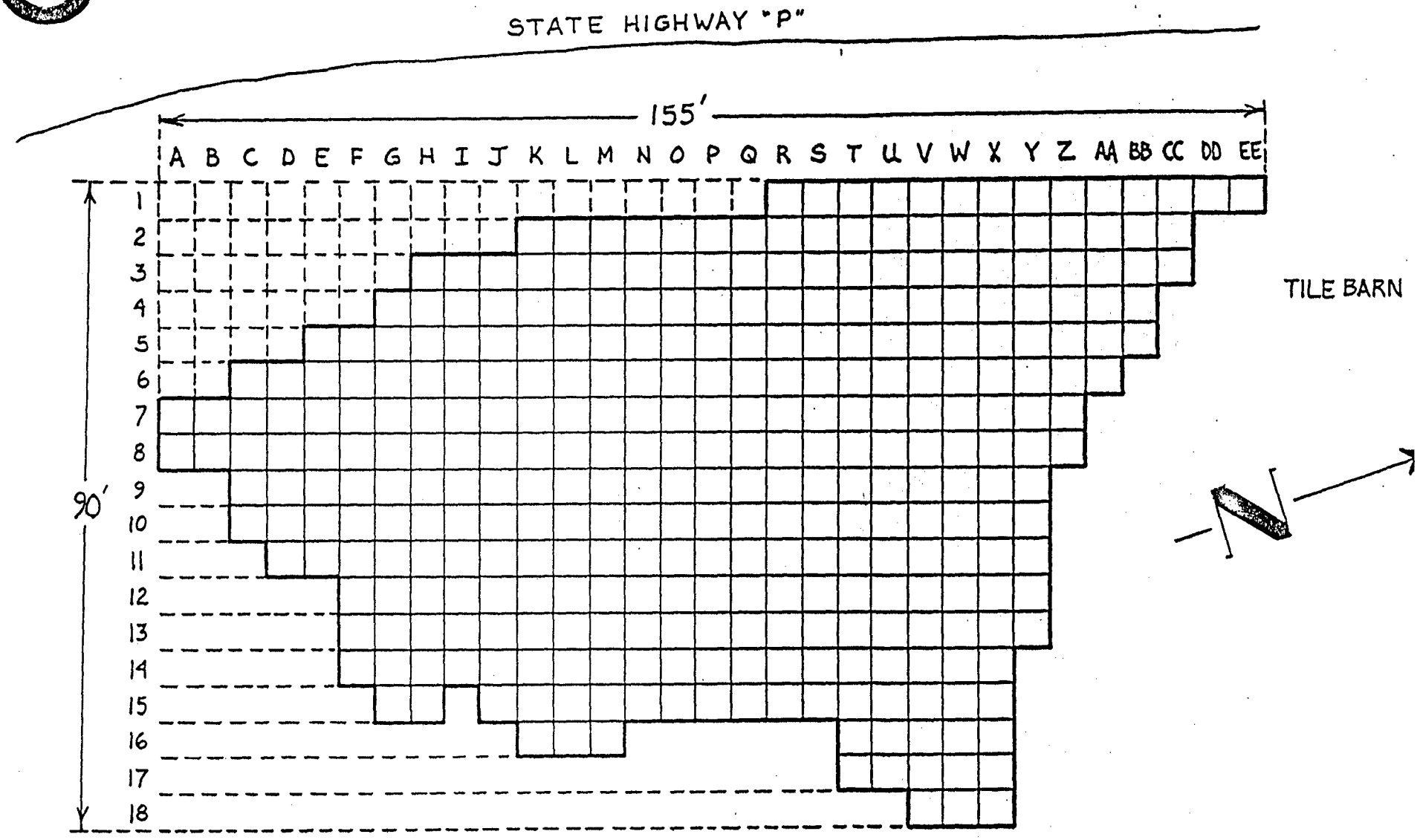


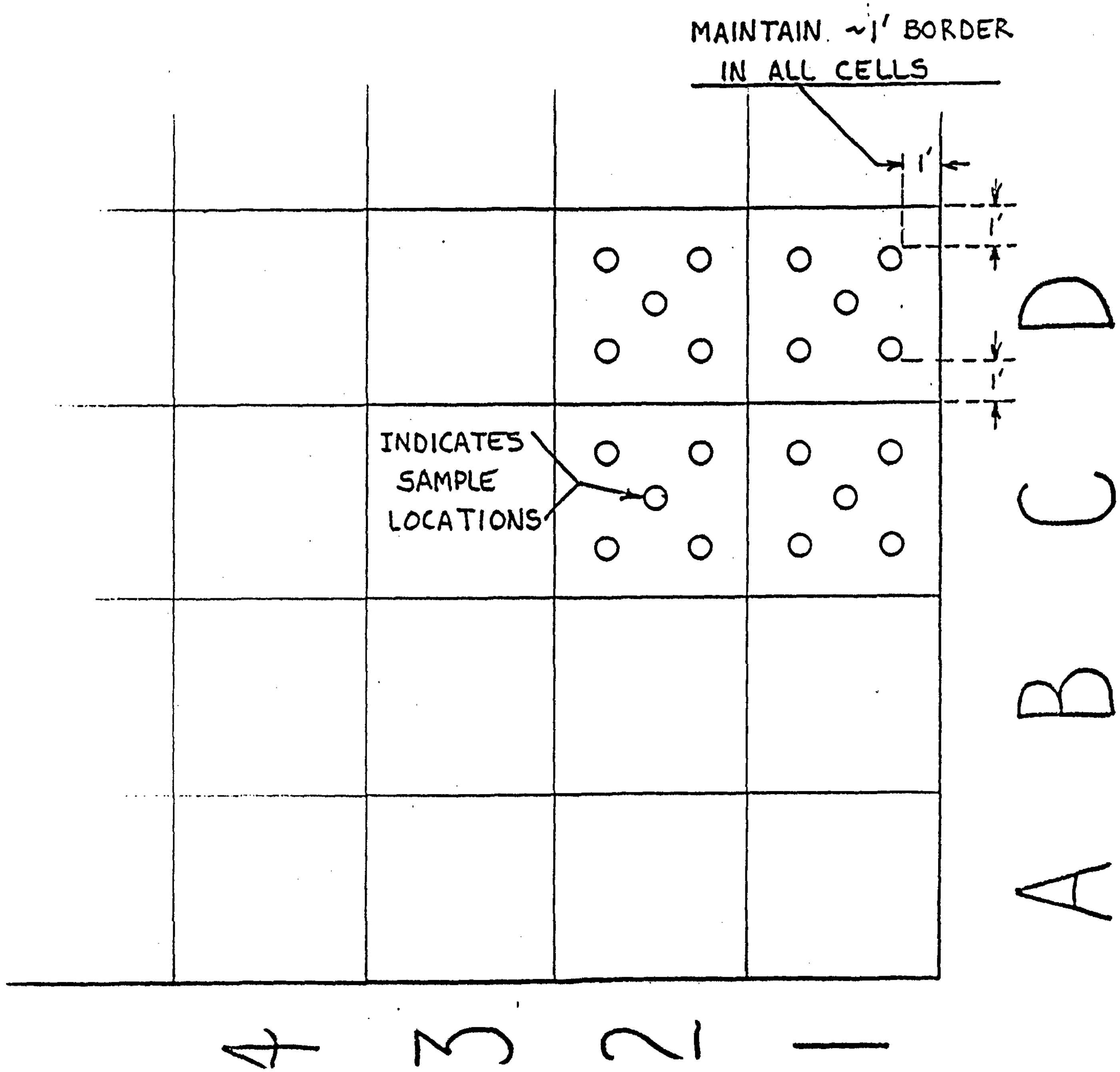
FIGURE 4

GRID LAYOUT FOR LIMESTONE PILE "C" LOCATED SOUTH OF HWY "P", WEST OF THE TILE BARN.
SCALE: 1/4" = 5'

TOTAL COMPOSITES	340
TOTAL SAMPLES	1700
TOTAL SQ. FT.	8500

FIGURE 5

GRID CELL LAYOUT SHOWING SAMPLE LOCATIONS WITHIN EACH CELL.



SCALE: 1/4" = 1'

FIGURE 6

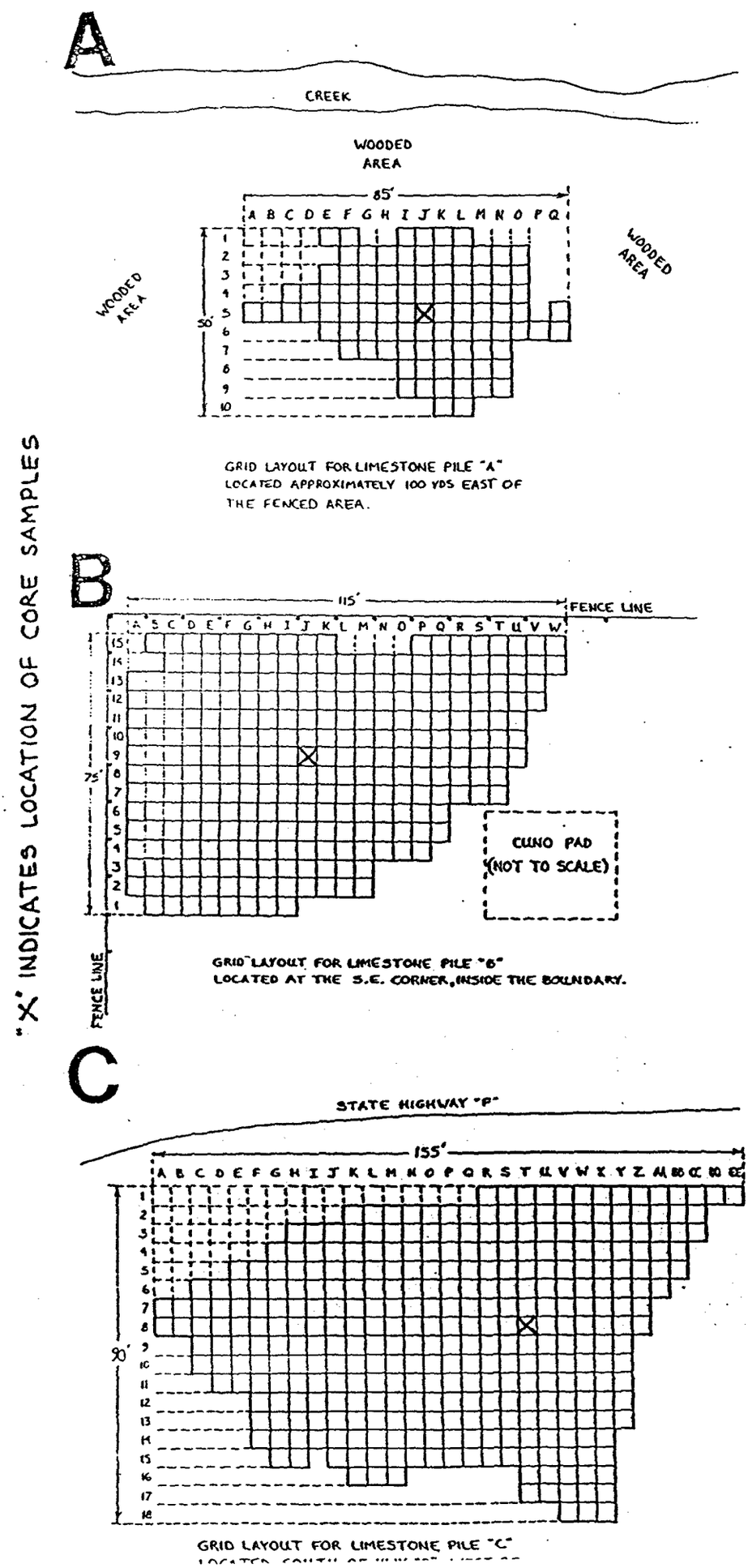

A
CREEK
WOODED AREA
85'
A B C D E F G H I J K L M N O P Q
1 2 3 4 5 6 7 8 9 10
50'
WOODED AREA
WOODED AREA
GRID LAYOUT FOR LIMESTONE PILE "A" LOCATED APPROXIMATELY 100 YDS EAST OF THE FENCED AREA.
B
115'
FENCE LINE
A B C D E F G H I J K L M N O P Q R S T U V W
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
75'
CUNO PAD (NOT TO SCALE)
FENCE LINE
GRID LAYOUT FOR LIMESTONE PILE "B" LOCATED AT THE S.E. CORNER, INSIDE THE BOUNDARY.
"X" INDICATES LOCATION OF CORE SAMPLES
C
STATE HIGHWAY "F"
155'
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z AA BB CC DD EE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
90'
GRID LAYOUT FOR LIMESTONE PILE "C"

TABLE 1

Spent Limestone Sample Analysis Results
(picocuries per gram)

LIMESTONE PILE "A"

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1					10	10			9	7	5	7					
2						12	7	4	18	1	4	2	1	9	9		
3					9	9	13	9	5	2	9	2	9	9	5		
4				22	25	22	1	12	12	10	-1	2	7	1	4	-1	
5	6	12	16	6	15	18	12	16	18	6	2	10	5	1	10		7
6					10	13	9	10	7	8	10	10	5	2	2	15	2
7						8	13	8	7	2	2	7	15	7			
8									5	5	6	-1	7	12			
9									13	5	12	4	4	13			
10											12	8					

CORE SAMPLES: 1 ft: 8 2 ft: 12 3 ft: 18

LIMESTONE PILE "B"

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
15		12	18	15	15	2	10	6	5	8	5					20	12	10	5	12	6	16	9
14			9	3	8	10	3	8	2	12	3	2	2	5	6	-1	5	22	7	8	22	15	12
13	10	9	16	9	15	6	3	10	10	5	8	5	13	8	13	9	18	13	6	15	3	14	
12	19	18	8	13	6	12	9	9	8	10	10	6	10	8	12	17	17	13	16	16	8	7	
11	8	10	13	8	8	9	23	13	6	6	10	6	9	15	6	20	12	18	8	13	11		
10	15	14	23	24	12	12	3	15	15	12	15	17	17	14	14	16	19	15	14	14	14		
9	26	25	64	20	21	30	5	12	12	13	19	10	5	13	12	10	8	9	10	13	20		
8	37	30	57	41	25	16	9	12	3	9	8	6	8	1	50	20	20	10	13	29			
7	26	39	29	16	21	16	10	13	4	21	18	10	7	13	6	8	8	4	13	18			
6	34	36	35	17	13	10	10	36	8	10	25	14	25	8	4	3	10						
5	27	13	25	11	13	23	17	12	17	0	47	16	27	30	24	20	11						
4	20	25	25	17	21	14	6	20	13	14	13	11	21	20	11	6							
3	4	17	13	16	21	23	7	18	16	6	6	16	17										
2	28	25	20	20	48	25	11	10	20	14	16	41	32										
1		68	20	26	18	27	24	14	18														

CORE SAMPLES: 1 ft: 6 2 ft: 12 3 ft: 25 4 ft: 10

LIMESTONE PILE "C"

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE
1																		7	4	2	2	12	15	7	5	7	12	5	10	1	2
2											10	15	2	2	-1	5	1	5	13	10	9	7	15	10	7	5	10	5	7		
3								12	2	2	13	12	7	5	5	2	9	9	4	5	5	2	2	7	4	-1	4	7	4		
4							9	5	9	7	5	-1	16	7	5	9	5	4	1	4	7	12	5	7	4	1	5	5			
5					15	1	2	10	2	-1	9	15	7	9	2	2	9	2	2	10	10	1	10	7	13	5	-1	10			
6			7	12	16	1	1	5	4	7	4	4	9	10	9	-1	5	-1	4	7	4	4	2	4	5	7	2				
7	12	7	15	15	12	2	1	4	7	7	5	4	5	12	2	5	12	12	5	2	4	4	7	7	7	4					
8	19	5	15	12	16	4	7	5	9	5	13	7	4	1	5	5	7	10	5	-1	4	5	1	10	4	2					
9			9	13	7	6	4	9	9	5	10	4	2	4	12	5	5	4	-1	2	5	2	4	7	7						
10			5	9	16	9	7	12	9	10	10	13	12	2	5	2	5	10	4	5	-1	-1	9	2	7						
11				12	15	7	5	10	9	13	13	9	9	13	9	2	9	2	9	12	9	4	1	9	9						
12						4	22	10	18	-1	38	16	9	5	9	13	1	9	5	12	-1	-1	5	-2	5						
13						15	12	13	7	4	7	7	2	2	2	4	4	7	12	7	1	10	5	15	5						
14						15	15	18	10	4	5	5	4	4	1	13	2	4	7	1	4	9	2	7							
15							7	13		10	-1	5	7	2	4	9	2	9	5	5	18	12	9	10							
16											2	13	12							2	1	9	5	9							
17																				1	2	5	8	4							
18																						5	4	5							

CORE SAMPLES: 1 ft: 14 2 ft: 14 3 ft: 4 4 ft: 6 5 ft: 11

TABLE 2

SPENT LIMESTONE FILL - DOWNHILL LIMESTONE MONITORING

(Picocuries per gram)

SOIL STATION 10	East of Plant			
Alpha	1985	1986	1987	1988
First Quarter		11	28	30
Second Quarter	10	14	57	22
Third Quarter	5	14	54	12
Fourth Quarter	8	30	18	18
Beta				
First Quarter		15	160	94
Second Quarter	40	33	150	140
Third Quarter	19	26	160	26
Fourth Quarter	36	120	38	43

SOIL STATION 11	North of Site Pond			
Alpha	1985	1986	1987	1988
First Quarter		9	13	67
Second Quarter	11	7	41	23
Third Quarter	6	54	34	37
Fourth Quarter	36	53	23	28
Beta				
First Quarter		22	34	55
Second Quarter	28	50	56	54
Third Quarter	23	84	61	58
Fourth Quarter	47	85	53	51

TABLE 3

QUARTERLY COMPOSITE AIR SAMPLING ABOVE LIMESTONE PILES

		Concentration ($\times 10^{-15}$ µCi/ml)		
		Inside Fence	East	West
1985	July - September	4.7	2.6	8.3
	October - December	7.8	3.9	2.7
1986	January - March	1.6	1.8	2.0
	April - June	*	1.2	1.0
	July - September	9.5	6.0	5.6
	October - December	8.8	7.6	5.8
1987	January - March	6.5	3.3	4.4
	April - June	5.8	4.0	2.0
	July - September	3.1	2.8	2.4
	October - December	6.6	4.4	3.8

*Sampler Down