

## 1958 COOPERATIVE CREOSOTE PROJECT--XIV: 35 YEARS OF FIELD EXPOSURE WITH POSTS

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**ABSTRACT:** In 1958 this field study of full-sized posts was initiated. This particular study is the only remaining part of a cooperative effort which was established to compare the performance of various types of creosotes and solutions. This paper provides data from the 35-year inspection of the southern pine posts.

### INTRODUCTION

This 14th report is part of a series of papers which has been presented to this association concerning the 1958 cooperative creosote project. (Partial list given in Literature Cited.) As previously indicated in the AWWA Proceedings, the initial project encompassed both laboratory, marine and land exposure tests for various creosote distillates and solutions.

The intent of the cooperative project was to evaluate service life performance of the various creosote materials. The original cooperators were representatives from Allied Chemical Corporation (now Allied Signal, Inc.), United States Steel Corporation (Aristech Chemical Corporation), Koppers Company, Inc. (presently Koppers Industries, Inc.) with the Bernuth Lembcke Company (presently KMG-Bernuth, Inc.) joining the group five years after the test was initiated. Additional background information can be obtained from previously published papers concerning the project which are given in the reference section of the paper.

It should be noted that two of the creosote distillates are close to the current AWWA specifications for P1/P13 creosote (termed C & G). The physical property characteristics of the distillates were reported by Stasse<sup>(7)</sup>. There are basically four different types of creosote preservatives which are listed as follows:

- Creosotes A, C, D, F and G were straight-run distillates.
- Creosotes B and E contained 2% pentachlorophenol.

- Creosote solutions H and I were 70/30 solutions meeting the then (1958) P2 solution standard.
- Creosote solutions J and K were 50/50 creosote/petroleum solutions.

These different types of creosotes were further characterized using the AWWA E-flask distillation apparatus, and a brief description of each is given as follows:

- A. AWWA P1-54 creosote, 41 percent to 270°C, 17 percent residue at 355°C, and 8 percent residue at 400°C.
- B. Creosote A + 2 percent pentachlorophenol.
- C. AWWA P1-54 creosote, 26 percent to 270°C, 19 percent residue at 355°C, and 5 percent residue at 400°C.
- D. Creosote, 13 percent to 270°C, 17 percent residue at 355°C, and 4 percent at 400°C.
- E. Creosote D + 2 percent pentachlorophenol.
- F. Creosote, 4 percent to 270°C, 28 percent residue at 355°C, and 5 percent residue at 400°C.
- G. Creosote (close to current AWWA requirements for P1/P13), 15 percent to 270°C, 22 percent residue at 355°C, and 5 percent residue at 400°C.
- H. 70/30 creosote-coal tar solution made with creosote A; 33 percent to 270°C, 32 percent residue at 355°C.
- I. 70/30 creosote-coal tar solution made with creosote D; 17 percent to 270°C, 33 percent residue at 355°C.
- J. 50/50 creosote-petroleum solution made with creosote A and 50 percent Bunker C petroleum (specific gravity 0.96).

K. 50/50 creosote-petroleum solution made with creosote D and 50 percent Bunker C petroleum.

As indicated previously, there were three categories with respect to the experimental program for the 1958 cooperative test. There were six different study areas, and these were listed as follows:

1. Soil-block bioassay.
2. Marine-block bioassay.
3. Accelerated field exposure:
  - a. land-stakes 3/4 by 3/4 by 18 in.
  - b. marine waters--boards 3/4 by 3 by 14 in.
4. Simulated service test with 7-ft. posts--land exposure.
5. Simulated service test with 4 1/2-ft. posts--marine exposure.
6. Evaporation studies--3/4 by 18-in. post sections.

Of these original six study areas, the only test currently being continued is the one with the 7-foot post sections which are exposed at the Blessing Plantation located 30 miles north of Charleston, South Carolina. The average nominal retention levels were 4, 6 and 8 pounds per cubic foot (pcf) for each of the 11 creosote materials. The information contained in this paper is a summary of the data from the most recent inspection. In addition, inspections have been conducted in 1967, 1970, 1974, 1978, 1983 and 1988.

An Index of Condition was developed and reported for each treatment condition for the southern pine posts using the following rating system.

Rating	Description of Condition
10	Sound
9	Surface softness to 1/8" depth
7	General surface decay, pockets up to 1/4" depth
4	Surface decay 1/2" or deeper
0	Failure -- posts were broken by a hard push

## DISCUSSION OF INSPECTION RESULTS

As previously indicated, most phases of this 1958 cooperative project have been completed. A total of 13 papers has been published as a result of this cooperative creosote effort. This paper gives the results on posts that have been exposed for 35 years at the Blessing Plantation in South Carolina.

One area that has been somewhat of a disappointment has to do with the total number of posts that have been lost or become missing. Some posts have been literally stolen, while hurricane Hugo created other casualties. The following is a brief list of the disposition and current posts that are in test.

Given in Table 2 is a comparison rating the performance of the five neat creosotes based on the soil-block test, 3/4-inch stakes and the 7-foot posts (data for 25, 30 and 35 years exposure). The performance of the creosotes once again showed a ranking with creosotes G, F and C significantly higher than creosotes D and A. It is interesting to note that the early test data from both soil-blocks and 3/4-inch stakes indicated a similar trend in the performance of the preservatives. To specifically illustrate the more volatile low residue creosote, A gave the poorest performance in soil-block, stakes and posts tests, while the higher residue, less volatile creosotes are performing more satisfactorily. Given in Table 3 is an Average Index of Condition for all 11 of the test preservatives -- creosote and creosote solutions as indicated in A through K. The addition of pentachlorophenol at a level of 2% shows a significant increase in the performance of the two neat creosotes. (Note the direct comparison of creosotes A and B.)

In addition, the data in Table 3 indicates that the creosote solutions H and I need to have a retention level of at least ten pcf to achieve long-term service life (35 years), while the creosote petroleum solutions J and K only require approximately an eight pcf threshold level of preservative retention to give satisfactory performance after 35 years in service. These direct comparisons between the neat creosotes, creosote solutions and creosote petroleum must be qualified with respect to the type of creosote material which was used in the 1958 cooperative project.

The reader of this paper needs to take into consideration that previously published papers have made specific direct comparisons between the

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various creosotes and creosote solutions and their performance in southern pine posts. These comparisons are valid and should be referenced. However, at this point after the 35th year inspection, it is of significance to note that the results between 30 years in test and 35 years for the posts do not show a significant deterioration in the performance over the past five years. This is indicated by the data given in the four tables.

### CONCLUSIONS

Undoubtedly, the two most valid conclusions that can be drawn from the 1958 cooperative project with creosote are listed as follows:

- The change in the AWPA standard for creosote to a higher residue (355°C) with a less volatile front-end portion of the creosote was a move to increase the service life of creosote treated wood products.
- It is expected that both creosote solution (P2) and creosote petroleum mixtures (P3) will give excellent service life when the retention level of these two products in the treatment of wood is somewhat higher than that for the neat creosotes (approximately 25% increase).

It is anticipated that the 1958 cooperative test for the southern pine posts will continue and an inspection will be performed after 40 years. The authors wish to acknowledge the assistance of all the original cooperating companies and R. G. Pfeiffer in physically helping with the most recent inspection.

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SESSION CHAIRMAN KENDERES: Thank you, Dave, for the presentation and for also letting me know that as Program Chairman next year, I probably should start working on my paper also.

Next we have a report of the Nonpressure Committee. This is a Committee that's been growing. It's been around for a few years. Alan Ross, who heads up this Committee, has been doing a great job at moving it along. I would like to now call upon Alan to give us an update on N-Committee activities. Al.

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TABLE 1  
Number of Posts Remaining in Test  
At 35 Years (Excluding < 3.0 pcf Posts)

Oil	Original Total	Number Missing*	Number Failures	Number Remaining
A	53	6	37	10
B	58	5	16	37
C	60	5	9	46
D	59	2	17	40
E	60	3	0	57
F	59	5	10	44
G	60	7	9	44
H	58	14	29	15
I	58	13	20	25
J	60	10	10	40
K	58	4	29	25

\*Missing posts are not included in the calculation of Average Index of Condition provided the last inspection grade was a 7 or higher. Those graded as a 4 were considered a 0 if missing during the 1993 (35 years) inspection. Any post that could not be removed due to damage caused in hurricane Hugo but were still in test were considered missing for the inspection.

TABLE 2  
Comparative Rank of Only Original Creosotes in Soil-Block,  
Stakes (Empty Cell) and Posts at 6 pcf Retention

Rank	Soil-Block	3/4" Stakes 20 yrs.	Posts 25 yrs.	Posts 30 yrs.	Posts 35 yrs.
1	F	F <sup>(57)</sup>	G <sup>(96)</sup>	G <sup>(92)</sup>	G <sup>(94)</sup>
2	G	D-G <sup>(30)</sup>	C-F <sup>(91)</sup>	F <sup>(90)</sup>	F <sup>(89)</sup>
3	D	-	-	C <sup>(85)</sup>	C <sup>(88)</sup>
4	C	C <sup>(22)</sup>	D <sup>(76)</sup>	D <sup>(63)</sup>	D <sup>(54)</sup>
5	A	A <sup>(20)</sup>	A <sup>(29)</sup>	A <sup>(16)</sup>	A <sup>(3)</sup>

( ) Indicate average index of condition in the 5.0 to 6.9 retention range.

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TABLE 3  
Average Index of Condition for Posts After  
35 Years in Service  
Creosote Retention (pcf)

Oil	4	6	8	10	>11.0
*A	12	3	33	48	0 <sup>(2)</sup>
B	31	63	92	88	97 <sup>(3)</sup>
*C	29	88	96	100	100 <sup>(2)</sup>
*D	45	54	48	67	96 <sup>(7)</sup>
E	87	92	99	100 <sup>(4)</sup>	0
*F	45	89	89	100 <sup>(2)</sup>	0
*G	43	94	100	100	100 <sup>(3)</sup>
H	6	27	40 <sup>(5)</sup>	100 <sup>(1)</sup>	100 <sup>(1)</sup>
I	0	53	66	80	100 <sup>(1)</sup>
J	46	62	94	97	--
K	10	46	88	--	100 <sup>(2)</sup>

Numbers in ( ) are number of posts in test.

TABLE 4

## Index of Condition for Posts at Three Retention Groups

Oil	Test Years	Retention (pcf)		
		<5.0	5.0 to 6.9	>7.0
A	20	35 (28)	43 (16)	74 (16)
	25	25	34	61
	30	16	17	43
	35	10	3	33
B	20	56 (22)	78 (17)	93 (21)
	25	50	71	93
	30	44	64	91
	35	28	63	92
C	20	72 (17)	94 (23)	99 (20)
	25	62	91	99
	30	46	83	98
	35	29	88	97
D	20	83 (26)	82 (14)	98 (20)
	25	67	82	89
	30	56	63	81
	35	43	54	65
E	20	93 (18)	99 (22)	100 (20)
	25	89	96	100
	30	90	93	99
	35	87	92	99
F	20	72 (23)	93 (25)	98 (12)
	25	62	92	92
	30	63	90	92
	35	47	89	91
G	20	78 (22)	98 (19)	99 (19)
	25	74	96	99
	30	69	92	99
	35	43	94	100
H	20	46 (23)	61 (27)	83 (10)
	25	26	57	81
	30	12	36	64
	35	6	27	57
I	20	26 (17)	67 (20)	82 (23)
	25	17	63	83
	30	3	53	80
	35	0	53	78
J	20	84 (16)	88 (24)	95 (20)
	25	69	82	96
	30	64	74	93
	35	46	62	96
K	20	29 (24)	66 (28)	86 (8)
	25	15	58	84
	30	11	51	81
	35	10	46	91

( ) Original number of posts in test.