

Decay of Log Home

Paul Stein, CR

March 1994



First General Services of Charleston, Inc.

Insurance Repair Specialists

P.O. Box 21587 • Charleston, S.C. 29413-1587 • Office (803) 554-2065 • FAX (803) 554-2068

March 10, 1994

APPRAISER'S STATEMENT

This Appraisal Report is based on the existing log home located at 1151 Sugar Plum Drive, Moncks Corner, South Carolina. The purpose of the Appraisal Report is to give an opinion on:

1. The use of silicone caulking applied at the log seams.
2. The possibility that the silicone caulk contributed to log decay.
3. Termite Damage.
4. Water damage on the interior.

The property was inspected and photographed on October 14, 1993. Additional site visits were made on November 19, 1993 and on January 5, 1994. Messrs Cam Lay and Cecil Hernandez, Pesticide Regulatory Specialist with the Department of Fertilizer and Pesticide Control and Mr. Fred Pliff with Pliff Consulting, specializing in log homes, were contacted for their expertise in their respected fields.

This report is a study and collection of information that can be used to assist in the mediation settlement. Limitations on it's accuracy and validity is based upon the information presented herein. I am in impartial party to this claim and have no interest in the property or the project itself.

Sincerely,

Paul Stein, CGR
President



INTRODUCTION

ASSIGNMENT DATE: October, 1993

INSURANCE COMPANY: Southern States Insurance Company

NAME: Mr. Robert Oxford

ASSIGNMENT: To meet with Mr. Oxford and review:

1. The use of silicone caulking at the log seams.
2. Decaying logs.
3. Damage by termites.
4. Water intrusion through the log seams.

PURPOSE OF ASSIGNMENT: To develop an opinion on who is responsible for the incurred damages.

ASSIGNED BY: Mr. Steve Jones
Suite A-13
100 Executive Center Drive
Edisto, South Carolina 29210

PREPARED BY: Paul Stein, CGR
President
First General Services of Charleston, Inc.

BACKGROUND

DATE OF LOSS: September 22, 1989

TYPE OF LOSS: Wind (Hurricane Hugo)

Mr. C.R. Potts, M.E.A. Project Engineer prepared a report dated June 22, 1992, for Southern States Insurance Company (See Exhibit C). The report was to address the extent of wind damage related to Hurricane Hugo. Repairs were made, yet the log home continued to experience water intrusion.

Allen Campbell with Star Engineering prepared a report dated June 26, 1992 (See Exhibit D) for Mr. Oxford identifying any structural damages and the cause of numerous leaks through the exterior wall system.

Information was obtained through the cooperation of Mr. Marky Mennis, Attorney at Law, Berkeley County, the Owner, and Engineers involved.

INVESTIGATION

Arrangements were made to view the log home on the morning of November 14th at 10:00 a.m. Mr. Oxford, along with his attorney, Mr. Markley Mennis, were present. A room by room inspection was made visually in accessible areas only and with the use of a Drieaz Probeless Moisture counter. The interior walls measured from 10% to 14% moisture content. A higher moisture count was generally found around the windows. The walls displayed "run lines" that were traceable to the roof system where roof timbers pass through the wall section (See Photographs 19, 20, and 21).

The floors had a higher reading of 12% to 15% (During the inspection of the crawl space it was noted that there was no floor insulation or vapor barrier). Scraped termite shelter tubes were viewed on the interior of the Kitchen cabinets (See Photograph 17) and on the wall of the Son's Bedroom wall (See Photograph 18). No active termites were visible.

Messrs. Cam Lay and Cecil Hernandez with the Department of Fertilizer and Pesticide Control, were contacted to evaluate the silicone caulking, wood decay and termite damage (See Exhibit A).

Using a moisture probe it was determined that the silicone caulking was not trapping moisture, causing the logs to decay.

The footings were pretreated by Perkin Exterminating Company, who were contracted by Mr. Oxford. A breach in the chemical barrier resulted in the firm having to return and retreat the affected areas. The specific areas with termite damage were the Kitchen and the Son's Bedroom (North Elevation). The process of retreatment required the foundation wall of the effected areas to be drilled. The foundation wall consisted of a concrete masonry unit (CMU), an air space of approximately one inch, then brick veneer (See Exhibit H). It was discovered by using a rod, checking the depth of the drilled hole that only the cell of the CMU was penetrated for retreatment. The void between the CMU and the brick veneer was left untreated.

Mr. Fred Pliff, with Pliff Consulting was contacted for his expertise in log homes (See Exhibit B). The house displayed excessive weathering (See Photograph 16). Additionally, there was no evidence of puttylastic installed along the exterior log seams as prescribed in the Product Data Information Sheet, supplied by Products Log Homes, Inc. (See Exhibit E). The roof over the bay window reveals asphalt cement applied over metal flashing and lapping onto the wood logs (See Photograph 11).

The original blueprints were viewed at Attorney Markley Mennis' office. Products, Inc., located in Avon, Maine, produced the plans drawn by initials "JJ" and checked by initials "AS", dated October 1, 1980. Making copies of the entire set was not deemed necessary at this time. Three quarters of the first floor page is missing. The log home package consisted of the main two story home attached

to the Garage by a Breezeway. The foundation system was not part of Products' package. The blueprint has faded and required enhancement on the copies in this appraisal. Exhibit F deals with General Notes and Recommendations for the builder, who in this case was Mr. Oxford. Exhibits J, K, and L lists the materials supplied by Products. Exhibit G is a Building Permit, numbered 2404, dated March 12, 1980, that was issued by Berkeley County to Mr. Oxford for the construction of his log home.

In preparing this Appraisal Report, David Caliendo with Products Log Homes, Inc. (telephone number 222-946-6413) was contacted. The request for a maintenance book for Mr. Oxford's house and general information to be mailed was rejected by Mr. Caliendo. The lack of cooperation by the manufacturer as to the recommended manufacturer maintenance program is an important issue. Reviewing the information that was available, and is incorporated in this report, suggests that a maintenance program was not followed and that during the course of construction specifications were not adhered to.

CONCLUSION

The Breezeway was part of the log cabin package designed by Products, Inc. purchased by Mr. Oxford. A portion of the Breezeway can be seen in Exhibit I. This xerox copy is a portion of the second floor from the original plans that were viewed at Attorney Mennis' office (the Breezeway lines were enhanced due to the fact that the blueprint has faded). Each side of the Breezeway that attaches to the Main House displays various stages of wood decay (See Photographs 6, 7, and 8). The termite shelter tubes that were visible in the Kitchen and Son's Bedroom are located in the same general area of the interior as the exterior displaying various stages of wood decay. Looking at the opposite end of the Breezeway where it attaches to the Garage no decay is visible. "Water run off" management and the omission of a water repellant product on the exterior surface contributed to the advanced stages of the North Elevation log decay as viewed in Photograph 6.

Mr. Oxford, acting as his own contractor, therefore assumed the responsibility of ensuring that the house was erected per the plans and specifications. Additionally, through his own "hands on experience" he would have acquired working knowledge on the maintenance of the logs. Scheduling required maintenance and the use of the proper products for the log seams.

It is my opinion that the retreatment by Perkin is not complete until the void between the CMU and the brick veneer has been flooded by chemicals. Had proper details for "water run off" management been observed and planned, wood decay would not be as severe at this time. Log cabins in a southern climate require a cyclic maintenance routine to ensure the logs' longevity. Mr. Oxford could have avoided the guess work of others in using silicone caulk by referring to the builder's package and following manufacturer's specifications.

Report of Structural Pest Inspection

DEPARTMENT OF FERTILIZER AND PESTICIDE CONTROL
256 POOLE AGRICULTURAL CENTER
CLEMSON UNIVERSITY
CLEMSON, SC. 29634-0394

EXHIBIT A

Date Issued: January 10, 1994

Inspectors: C. Hernandez, K. Williams

Homeowner: Robert

The property in reference to Robert located at 1151 Drive, Moncks Corner, SC 29461 was inspected by the above Regulatory Specialists of the Department of Fertilizer and Pesticide Control on 19 November 1993 and the following conditions were found. This report details those findings as they relate to wood destroying organisms, their damage, and standard procedure required to control and report the presence of those organisms.

This inspection is based upon visible evidence in readily accessible areas only, and does not attempt to reveal or address all damages which may be present. All references to direction in this report are given from and facing the front of the structure. This inspection addresses only the crawlspace of the main structure, portions of which were inaccessible due to ductwork (see attached graph).

Partially scraped subterranean termite shelter tubes and subterranean termite damage was present in the back center of the house (inside a kitchen cabinet on the log facade) and in the back left room on the log facade. This structure is a log cabin, with the inside walls being finished logs.

This structure was pretreated for subterranean termites by Exterminating Company, Inc., on March 3, 1981, retreated in the fall of 1992 (approximately in August-September), retreated again in the Winter of 1993 (approximately in January-February) and is presently under contract with them. All of the section(s) of the Rules and Regulations for the Enforcement of the South Carolina Pesticide Control Act (the Standards for the Prevention or Control of Wood Destroying Organisms) were met during these treatments.

The wood-moisture content readings in the substructure ranged from 14% to 17%, with readings below 20% considered not excessive.

Excessive moisture levels, active decay, and decay damage were present on the outside facade (which is a log cabin), which was restricted to areas immediately surrounding cracks,

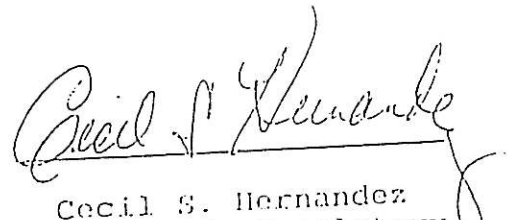
Mr. Robert
Page Two

checks, and other openings in the logs where rainwater had penetrated. Decay damage was most severe in the area to the rear of the kitchen door at the right side of the structure; a significant fraction of the roof runoff is directed onto this area by the design of the building and is the most likely cause of the decay damage. Similar, but less severe, damage exists in the area in front of the kitchen door and in a few other small areas where large amounts of runoff are directed onto the logs.

Questions have arisen regarding the effect of the silicone caulking that has been applied between the logs and over some cracks and checks. Wood moisture-content readings obtained (through the caulk) in areas immediately below the caulking were 13% to 15%, the same as readings obtained in undamaged areas. It is unlikely, therefore, that the caulk between the logs has had any deleterious effect.

Questions regarding the presence and extent of any structural damages, the need for or quality of repairs to this structure, or the source or control of the moisture problem in the area of active decay fungi should be referred to an appropriate qualified contractor, building expert, or structural engineer.

SUBMITTED BY


Cecil S. Hernandez
Pesticide Regulatory
Specialist

enclosure

cc:

K. Williams, Pesticide Regulatory Specialist, DFPC.
Paul Stein, First General Services of Charleston, Inc.

DEPARTMENT OF FERTILIZER AND PESTICIDE CONTROL

Wood Destroying Organisms Activity And/Or Damage Graph

OWNER'S NAME Robert

DATE 19 November 1993

ADDRESS OF STRUCTURE 1151

city Dr

state Monck

zip 29161

HOME PHONE 761-

BUSINESS PHONE 261-

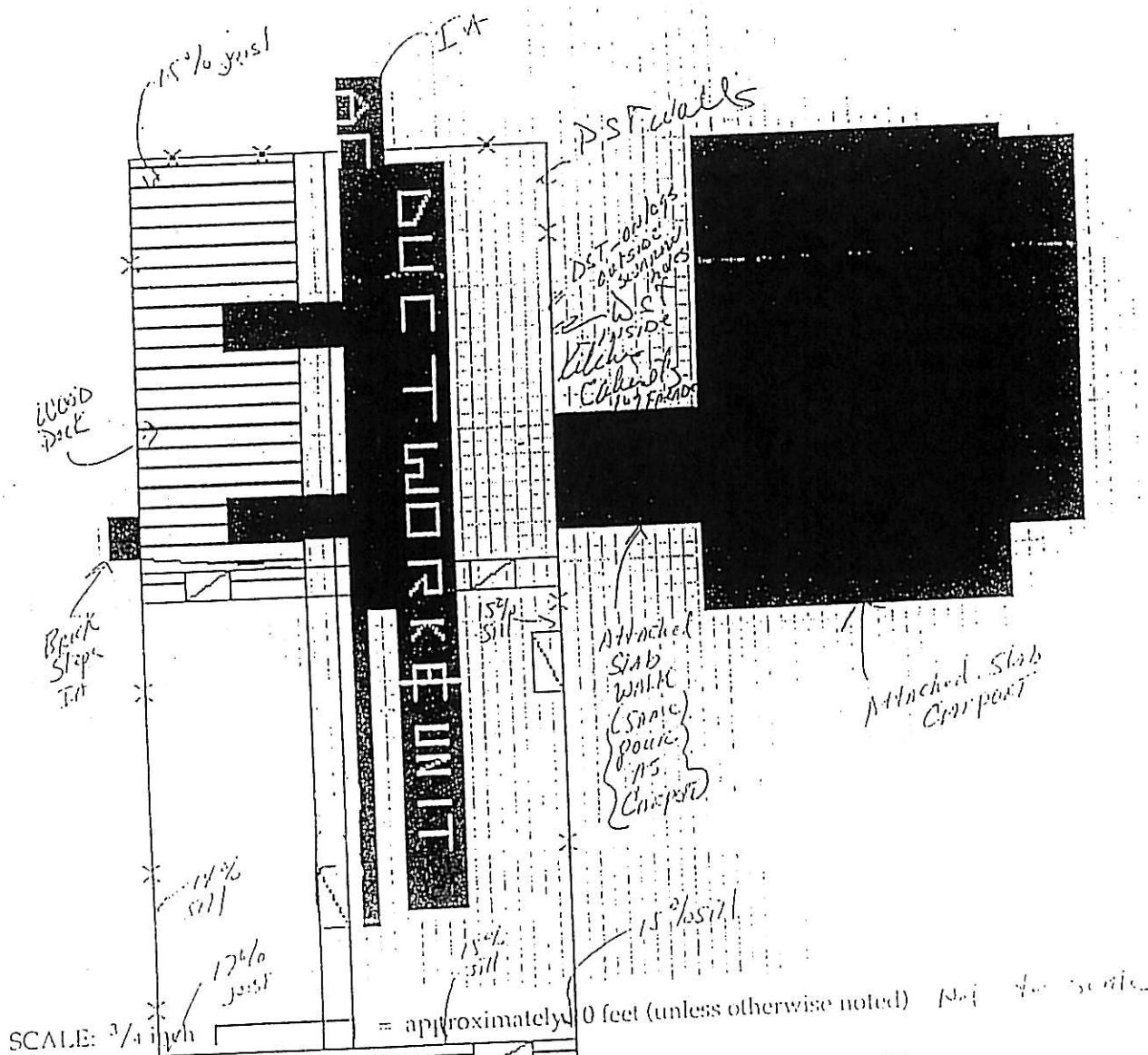
INSPECTED BY Wendy

Wells

VAPOR BARRIER PRESENT? YES ☒ NO

SUBSTRUCTURE INSULATED? YES ☒ NO

AGE OF STRUCTURE 5 years



WOOD DEST

- CA = carpenter ant
- CB = carpenter bee
- DW = drywood termite
- OH = old house borer
- OWB = other wood borers
- PPB = powder post beetle
- ST = subterranean termite

- D = damage area delineated
- F = fungi
- % = percentage wood moisture content
- SMM = surface molds & mildews
- SW = standing water

AND OTHER SYMBOLS KEY

- = chimney
- = crawlspace access
- ⊕ = earth filled
- X- = foundation vent
- IA = inaccessible area
- * = plumbing leak
- RPRS = repairs
- Xr = well vents
- WTC = wood to ground contact

OTHER SYMBOLS

A "D" placed before an activity symbol indicates damage from that pest exists.

This inspection graph is based on visible evidence of readily accessible areas and does not make any attempt to reveal all damage which may be present. No attempt to remove insulation, carpeting, paneling, etc., to search for hidden damage was made. Where visible damage was present, it was noted.

INSPECTION REPORT
ROBERT RESIDENCE
PINOPOLIS, S. C.

- I. A. At the request of Mr. Paul Stein, First General Services of Charleston, Inc., a physical inspection of the home was conducted by this individual on Wednesday, January 5, 1994. The intended purpose of that inspection was to assist in determining possible causes and solutions to exterior log decay and apparent incursion of wind blown rain through to the inside walls.
- B. The conditions covering that inspection were as follows:
1. An inspection of the interior living spaces was performed.
 2. A crawl space inspection was performed.
 3. A ground level exterior inspection was performed.
 4. One (1) attic space, where accessible by pull-down stairway, was inspected.
 5. No invasive inspection techniques were performed (nor requested). Moisture Meters were utilized, one (1) with longer probes, to determine present water retention of log surfaces both at joints and in log surface centers.
 6. A number of photos, previously taken by Mr. Stein, were studied.
 7. Copies of the reports of M.E.A. and Star Engineering were studied as well as product related correspondence from Products Log Homes, Inc.
- II. A. The structure inspected is a two (2) story log home with attached garage. The main house is constructed of milled or sized "logs" with insulation slots. The garage is conventionally constructed utilizing "slab" cut partial logs which aesthetically match the main house. Little or no abnormal deterioration was observed on the garage exterior.
- B. The exterior of the main house exhibited the following:
1. A number of badly rotted logs, particularly in the area of the connecting breeze-way (house to garage). (west side)
 2. Scattered deteriorated surface areas on the rear or south side of the structure.
 3. Scattered areas of caulking, apparently silicone, were observed on exterior walls.
- C. The interior living spaces (exterior walls) showed evidence of "run lines", apparently caused by water coursing down from around roof support beams and

window openings. There was evidence of subterranean termite shelter tubes in the kitchen cabinets (west wall) and in a bedroom, also west wall area.

- D. An inspection of the crawl space indicated a moderately dry soil surface, average to below average wood moisture (sills and joists) except under porches (north and east sides) where some rot and high moisture readings (20-24%) were found. Interestingly enough, the porch decking which, even though covered by roof overhang is somewhat weather exposed, is not CCA treated material.

III. Findings and Opinions:

1. Questions have arisen concerning the possible racking effect of hurricane winds (Hugo). It should be pointed out that this inspector did not plumb the corners as the result would not have answered the question - did Hugo rack the building or was it built out of plumb?
2. As to the exterior log deterioration, no insect damage or presence was observed in the exterior logs. The damage appears to be totally from rot organisms. Rot or wood decay differs from insect depravation in that the biodegradation of the wood occurs in the presence of an abnormally large amount of water and from a growing plant. The spores of the various wood decay fungi become airborne and ultimately attach themselves to dampened wood surfaces. Those surfaces which dry as rapidly as they wet, can rarely support the growth and development of the decay organism. These plants, which lack chlorophyll, mature by putting down roots (hyphae) which "sap" the strength from otherwise sound wood. The logs contained in the home appear to be pine. In most pine timbers, a fiber saturation point (28% by volume) is required to support the growth of wood decay fungi.

Nearly all the log home manufacturers we have dealt with over the years recommend maintenance of log exteriors at about two (2) year intervals with different water repelling products. Some of these products can be incorporated with stains or colors, others are applied clear.

3. In reading the product data sheet for the product "Puttylastic", I see that the manufacturer, recommends the caulking of exterior "log seams" some 12 to 18 months after construction. Except for silicone applied (apparently by person) during the "Hugo Repair", there is no evidence that the post construction recommendation by the log home manufacturer was ever carried out.

4. Questions have arisen concerning the efficacy of the silicone caulk, as applied to the house. Moisture meter readings taken during the 5 January 1994, inspection would indicate that the caulking attempt fell far short of what was needed to control the rot but did not, in my opinion, worsen or exacerbate the situation.

IV. Summary:

1. As to the subterranean termite problem, little if any structural damage is apparent. Obviously some esthetic damage to interior surfaces is present. The present termite treatment does not meet all state standards and should, as a minimum, be brought up to standard.
2. The rotted logs should either be replaced or suitably repaired. The corner "tail" logs which interfere with roof damage should be corrected and the existing flashing torn out and reworked.
3. After a suitable drying time, the exterior surfaces should be caulked (as per manufacturer's specifications) and an effective water repellant finish applied.
4. Rotted porch columns and decking should be replaced with CCA treated timbering.

-End Report -
P liff Consulting
January, 1994

1. INTRODUCTION

1.1

On May 7, 1992, Mr. Herman Melzer of Insurance Company in Columbia, South Carolina, requested that M.E.A. examine the Robert log home in Pinopolis, South Carolina.

1.2

Specifically, M.E.A. was requested to examine the log home and to render a professional opinion regarding the presence and/or extent of current damage related to Hurricane Hugo. M.E.A. was informed by Mr. Melzer that the residence had sustained some damage resulting from hurricane Hugo which had subsequently been repaired and that the log home has continued to have water leakage problems since that time.

2. PROCEDURES

2.1

Prior to M.E.A.'s examination of the log home, Mr. Potts reviewed information regarding the claim furnished by Mr. Melzer of , including estimates dated October 4, 1989 and February 7, 1990 from Homes, an estimate dated March 28, 1990 from R. C. I General Contractors, Inc., a letter report dated March 25, 1992 to Homes from Theodore G. Padgett, P.E., and other miscellaneous documents.

2.2

On May 11, 1992, Mr. C. R. Potts, M.E.A. Project Engineer, visited the site and performed a visual and photographic examination of the residence.

2.3

Field notes and a diagram of the premises showing the locations and direction of M.E.A.'s photographs and other pertinent information were recorded at the time of the site visit.

2.4

Mr. Potts was met at the site by the insured, Mr. Robert [redacted], who provided M.E.A. information regarding the history of the residence and the reported damage. Note, M.E.A.'s preliminary findings were discussed briefly at that time.

2.5

Mr. Potts interviewed Mr. Alan Cambell, P.E., of Star Engineering, by telephone several times subsequent to M.E.A.'s examination of the log home. Mr. Cambell had been retained by Mr. [redacted] to render an opinion regarding the damage to his log home and to make appropriate repair recommendations. Both Mr. Cambell's and Mr. Potts' findings were discussed at these times.

2.6

Subsequent to the site visit, Mr. Potts also interviewed Mr. David Caliando, P.E. of Products Log Homes, Inc. Mr. Caliando's company reportedly designed Mr. home and supplied the logs.

2.7

M.E.A. also reviewed various pamphlets regarding general log home construction furnished by Products Log Homes, Inc.

3. OBSERVATIONS AND ANALYSIS

3.1

Figures 1 through 35 are representative views showing the log home as found May 11, 1992. Two diagrams are appended which show the approximate locations of the photographs in this report.

3.2

Figures 1 and 2 are views of the front (east) side of the log home; Figure 3 is a view of the south side of the home; Figures 4 and 5 are views of the west side of the home; and Figure 6 is a view of the north side of the home. The exterior of the home appeared to be in good overall condition, though normal checking cracks had developed in the pine logs. A clear sealant had been applied to some of the cracks and joints reportedly caused as result of Hugo, to prevent water from entering the building. Note, it is M.E.A.'s understanding that it had been claimed that several of the exterior walls had also shifted or bowed as a result of Hugo, contributing to the water leakage problem. Though M.E.A. did confirm the presence of several alignment abnormalities with the log walls, the physical evidence clearly indicated these phenomena resulted from minor construction deficiencies and not Hugo.

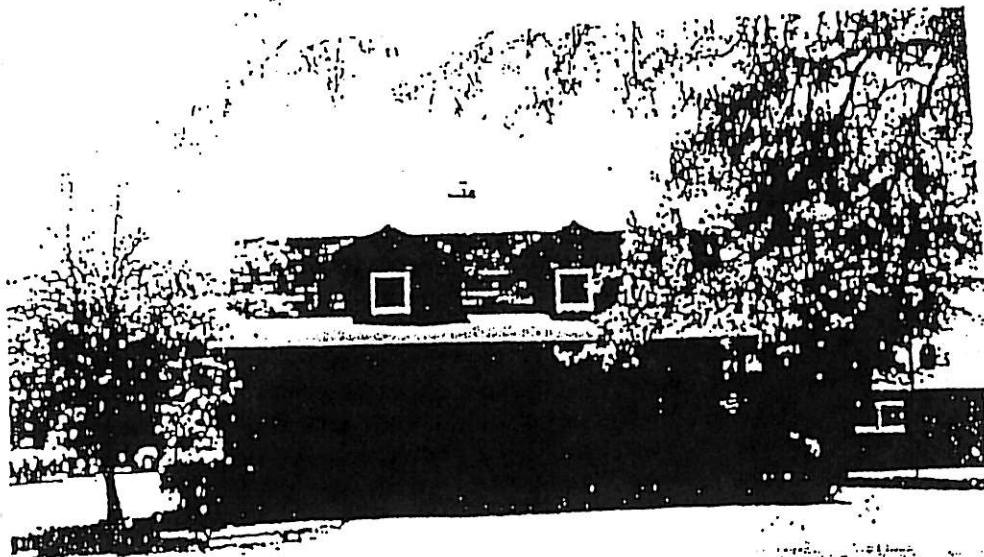


FIGURE 1

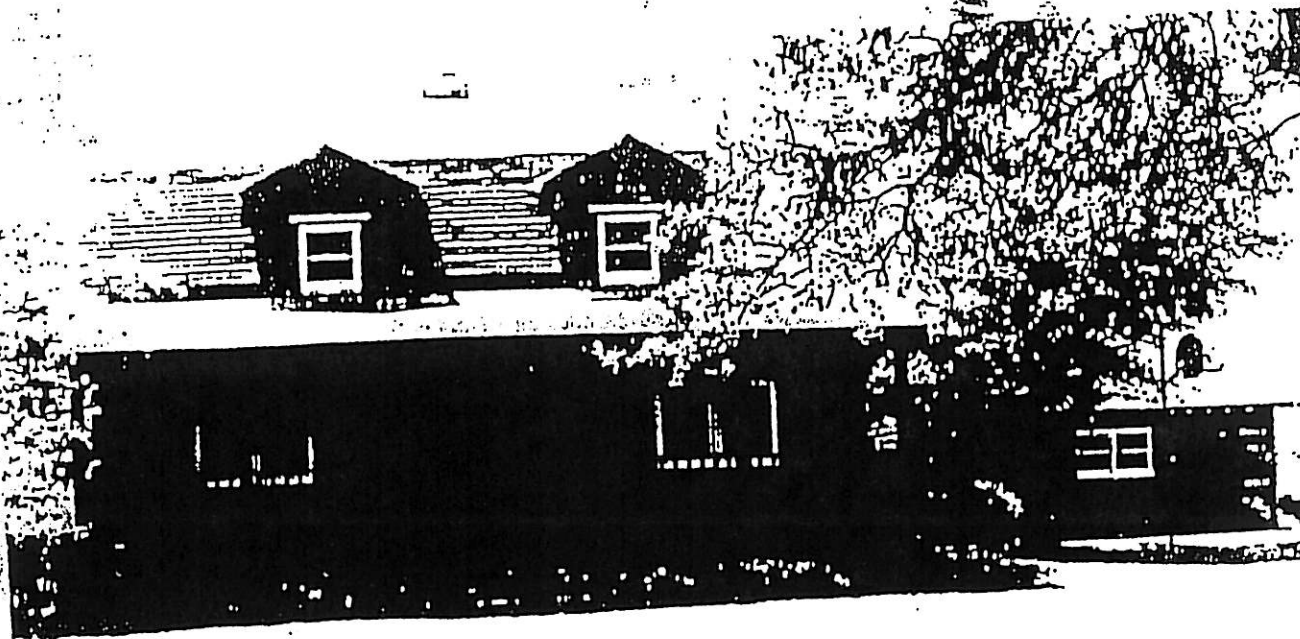


FIGURE 2



FIGURE 3



FIGURE 4



FIGURE 5

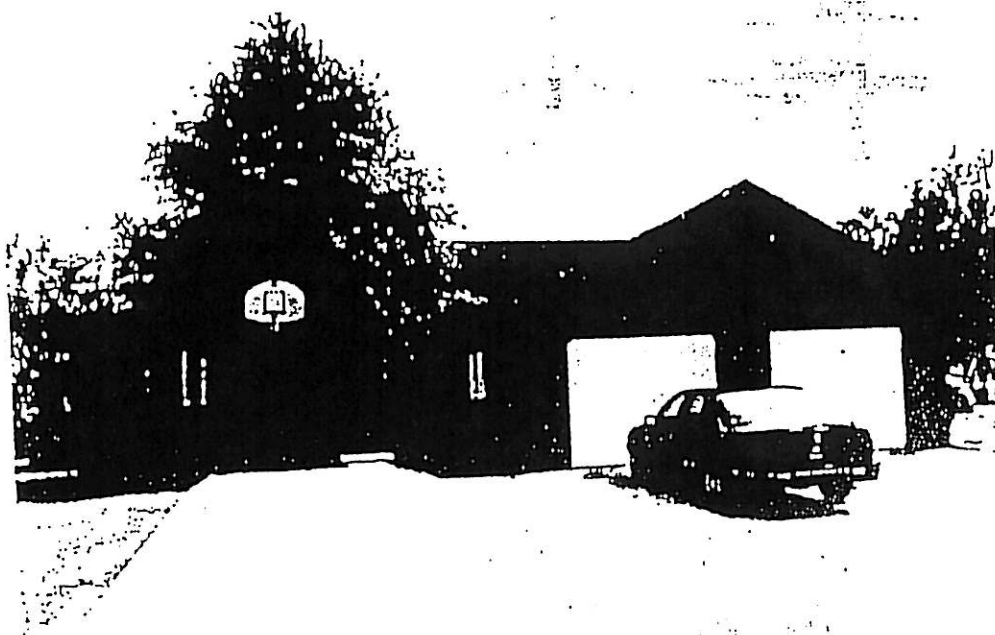


FIGURE 6

3.3

Figures 7 through 16 are various closer views showing the typical condition of the exterior of the pine logs. The application of the clear silicone caulking appeared random, discontinuous, and unsightly. In fact, it is M.E.A.'s opinion that the application of the silicone sealant, as found, might have even contributed to rather than alleviated the current water leakage problem. Literature furnished to M.E.A. by Products Log Homes, Inc. indicated periodic maintenance is required, such as the application of sealants and caulking, to protect the home from damage and water penetration. M.E.A. was also informed by the manufacturer that a silicone caulking was unsuitable for this purpose because the seals tend to rupture as a result of normal seasonal movement (expansion and contraction) of the pine logs. Note, the decay marked by the red arrows in Figures 15 and 16 below resulted from improper sealing and flashing details and not Hugo. The appended diagram shows the approximate locations of these photographs.

3.5

Figures 29 through 35 are various interior views showing the typical checking cracks, butt joints, and water stains. The water stains appeared to occur at random locations and were fairly prevalent throughout the interior of the home.

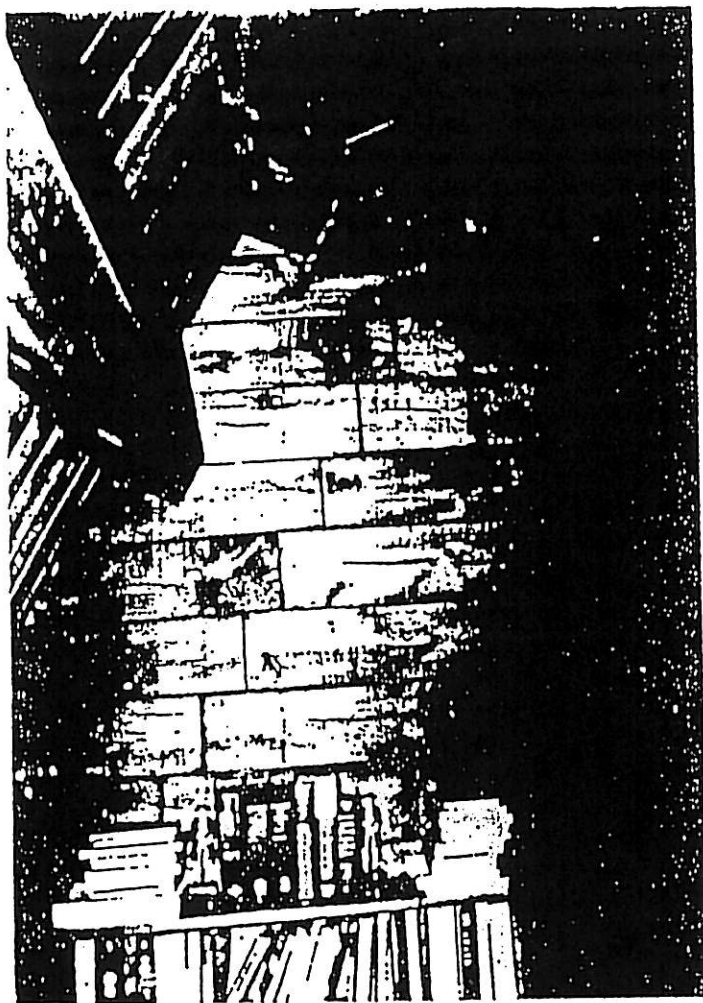


FIGURE 29

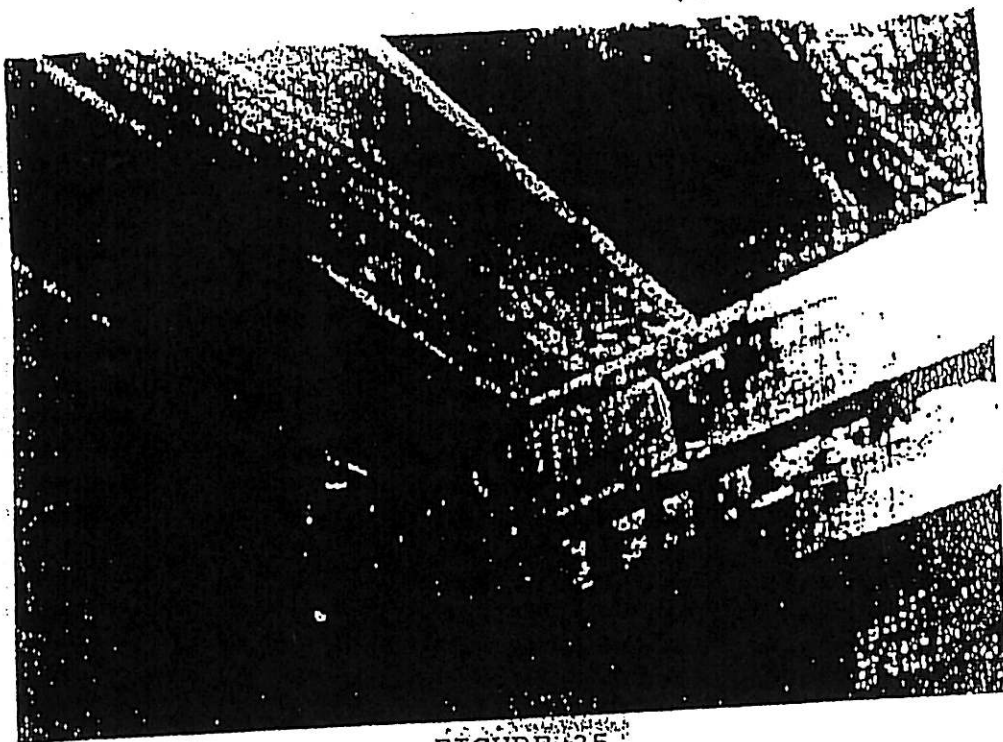


FIGURE 35

3.6

The following summarizes the information obtained from
the insured, Product Log Homes,
Inc., and M.E.A.'s physical examination:

- (1) Repairs made as a result of Hugo included an allowance to caulk the exterior to stop water from leaking into the log home.
- (2) Homes sealed various exterior cracks and joints with a clear silicone caulking.
- (3) The interior was reportedly refinished to eliminate the water stains present after Hugo.

- (4) Water apparantly has continued to penetrate the exterior of the log home since Hugo repairs were made, resulting in additional interior water stains.
- (5) There were water stains in the interior of the home emanating from the ceiling, ceiling beams, windows, checking cracks and horizontal joints.
- (6) The water penetration into the home was not consistent with nor a result of structural damage to the log home resulting from Hugo.
- (7) Silicone caulking was unsuitable for use as an exterior sealant, according to the manufacturer. A special log home caulking was and is available through L... Products Log Homes, Inc.
- (8) Periodic routine maintenance, such as re-sealing and caulking of the exterior are required to ensure the long-term serviceability of the pine logs.

4. CONCLUSIONS

4.1

Based upon M.E.A.'s investigation into the subject loss, it is the opinion of M.E.A., Inc. that:

- (1) The log home has not sustained deformation or structural damage as a result of Hugo.
- (2) The log home currently appears to be experiencing water penetration into the home which has resulted in interior cosmetic damage (water staining).
- (3) The current problems and damage are at least partially the direct result of and may have been aggravated by improper repairs which utilized silicone caulk to seal cracks in the exterior walls.
- (4) The only current repairs indicated are refinishing the interior of the house and re-sealing the exterior checking cracks, horizontal and vertical (butt) joints, as necessary, in strict accordance with the log home manufacturer's recommendations. Note, a controlled leakage test utilizing a garden hose may help reveal those areas where the water is penetrating the exterior logs, though this test alone should not be considered conclusive. M.E.A. suggests that the manufacturer be contacted by the

suggests that the manufacturer be contacted by the insured to confirm suitable repair measures prior to beginning work.

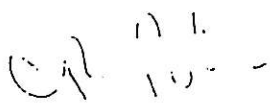
(5) M.E.A. found no physical evidence or hidden damages which were not addressed as a result of the initial Hugo claim.

(6) If problems persist with the log home after thorough sealing of the exterior has been completed, then M.E.A. again suggests the log home manufacturer should be contacted directly so that they may address the problems first-hand.


FINIS

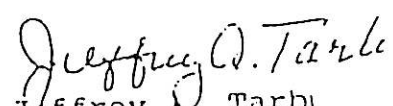
M.E.A., INC.

Investigation Performed
and Report Prepared By:

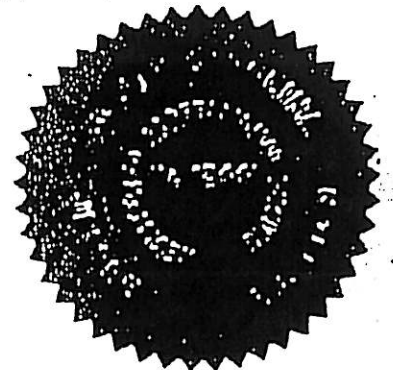

C. Richard
Project Engineer

Report Reviewed By:


J. Robert
Regional Vice President


Jeffrey D. Tarble P.E.
Civil Engineer
State of South Carolina
Registration No. 441

vh/B3



702-11-1
June 26, 1992

Mr. Robert L.

Re: Products Log Homes, Inc.
Residential Log Home
Pinopolis, SC

Dear Mr.

The subject dwelling was inspected to determine the cause and extent of any structural damages. The purpose of this inspection was to investigate damages caused by Hurricane Hugo on September 21-22, 1989. The following report is a summary of my findings.

DESCRIPTION

The inspected structure is a two story, single family home built of individual interlocking logs. These logs consist predominantly of eastern white pine and were distributed by Products. The structure is built over a crawl space on a shallow foundation. The roof consists of composition shingles configured in a gambrel fashion. For orientation purposes the front of this structure faces north.

OBSERVATIONS

A visual inspection was performed of the interior, exterior and roof of this structure. The primary focus of this inspection was the identification of any structural damages and the cause of numerous leaks through the walls of the structure. The most significant findings of this investigation are described as follows:

- An inspection of the exterior identified evidence of previous repairs to checks (cracks in the logs are defined as checks) in the surface of the logs. Many of these checks are rather severe and have been filled with silicone caulking. Based on your statements the method of repair to these checks was mutually discussed and agreed upon between your adjuster and your contractor. This information was also confirmed through your contractor, Mr. Andy Homes. Mr. Richard the insurance company's engineer of M EA, also confirmed there were notes in the file regarding repair procedures and negotiations between the adjuster and your contractor.
- The application of the silicone caulking was very extensive throughout the exterior of the logs. Silicone was visible in many of the checks, at butt joints, near the flashing and at corners. In several locations the application of the silicone caulking is coincidental with the location of visible wood decay and termite damage. The silicone has been applied predominantly at the surface rather than deep inside the checks and joints. It appears the silicone caulking has served to trap moisture in the logs, increasing the likelihood of wood decay and moisture related termite infestation.
- A plumb bob was suspended from the ceiling of the gabled end walls on the east and west ends of the structure. The walls were determined to be out of plumb in both locations. Various gaps in the log's joints and a horizontal misalignment were also identified associated with these end walls. It was determined these conditions were not associated with the hurricane force winds.
- Substantial evidence of water damage to the interior of the house was visible in many locations. This damage was exhibited by substantial water stains and associated streaking on the flat, interior face of the walls. These stains were most prevalent on the end gabled walls directly below the purlin penetrations through the walls. However, stains were also visible at various locations other than below purlins, but to a lesser degree. You had stated this staining occurred immediately after the storm originally, but has recurred due to the ineffective repairs. The repairs now remain ineffective, water continues to penetrate, and the damages are becoming aggravated.

CONCLUSION

A visual inspection of the interior, exterior and roof of this structure revealed substantial damages directly related to Hurricane Hugo. Based on the findings of the field inspection, major wind-related structural damage to the walls can be eliminated. The current damages to your home are not structurally related, nonetheless, should be considered very significant. These damages are directly attributable to moisture intrusion and will likely lead to far greater damages

age 3 F.N. 702-11-1
Residential Log Home

should they not be corrected. Based on your assessment of the performance of the structure during and after Hurricane Hugo and also statements from Mr. David aliendo, engineering representative of Products Log Homes, it is likely the severe windload may have slightly altered the connections and gaskets which form the watertight seals between the logs. Structurally speaking, this damage is considered minimal. However, with respect to leaks, cosmetic damage, and long term moisture damage the ongoing moisture intrusion is a major problem.

The initial repairs to your home were implemented by your contractor based on a mutually agreed upon procedure between your contractor and the adjuster. However, this repair procedure is now one of the primary causes of the ongoing problems. The silicone caulking allows moisture to penetrate many of the checks and then causes the logs to retain some of this moisture. Additionally, the silicone also does not satisfactorily prevent moisture from penetrating into the interior of your home through joints, checks and connections. This has resulted in additional cosmetic damages to the interior. However, the greatest potential for significant damage to the logs is related to retained moisture in the wood. These logs are likely a new growth, eastern white pine. New growth timber has minimal resistance to decay with respect to trapped moisture and termite infestation. This problem will likely continue to worsen until it is corrected.

In order to correct the damages to your home the ongoing leaks must first be eliminated. It is recommended that all silicone caulking be removed from the logs. An acceptable material such as Puttylastic caulking from Products Company should be used for all future repairs. A product data sheet has been provided for your information. Puttylastic should be applied full depth into gaps at penetrations of the 6 x 8 roof purlins through the walls to prevent future moisture intrusion. Additionally, any large checks at butt joints and end joints in the logs should also be filled full depth to 12 inches on either side of the joints. It is likely these are the two main sources of the moisture intrusion. If there are large, upward facing checks in the logs away from the butt joints, these should also be filled if there is concern they may leak. Additional problem areas should also be filled as required. As we discussed, it is recommended this procedure be performed in a single location initially to confirm a successful repair. Once this repair procedure has proven satisfactory, all other leaking areas can be repaired in this manner.

The wood decay and termite damage is a related problem which must be repaired using a different procedure. In order to eliminate the termites they must first be treated and excess moisture must be removed from the logs. The excess moisture in the logs should evaporate once the silicone has been removed and the leaks are repaired. The areas of wood decay and termite damage in the logs can be repaired by removing the areas of decay down to solid wood and


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Residential Log Home

patching with a satisfactory wood filler. This procedure is very common and there are many of these products on the market. If you need a particular product name I can provide one. The wood filler should be applied in accordance with the manufacturer's recommendations. If there are areas where the extent of decay and termite damage cannot be confirmed, these areas can be sampled by drilling the logs with a long, small diameter, wood bit. Soft areas in the wood will be easily detectable. Test holes in the logs should be patched with wood filler.

Please refer to the attached photographs and manufacturer's product data following this report for more information. Additional related photographs are available upon request.

If you have any questions concerning this investigation feel free to call me.

Sincerely,
Star ENGINEERING, INC.


Alan O.

P.E.

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PRODUCT DATA

PUTTYLASTIC LOG HOME CONSTRUCTION CAULK
"The Soft Seal"

Formula Numbers
55-99LCS - Natural Bronze

PURPOSE - An internal construction sealant applied between the logs during the stacking of log walls.

DESCRIPTION - Puttylastic is an excellent, all-weather construction caulk. Unlike other caulks, it is not as sensitive to adverse weather conditions; has better tube stability, and possesses qualities that are more suited to the unique nature of log homes. Puttylastic is designed to "cure" extremely slow. Its distinguishing feature is its ability to provide a soft, fluid, seal that can more readily adjust to and absorb the multiple forces and tensions exerted by log movement. It will form a "skin" within 48 hours and remain soft to touch for an indefinite period of time.

SURFACE PREPARATION - Surface must be clean, sound and dry.

APPLICATION - Apply Puttylastic with a caulking gun. Use on dry, calm moderate days.

INTERNAL SEALING - (between the logs) - for best results, a caulking tolerance of at least 1/8" should be engineered in the log design. Apply a 3/8" to 1/2" rounded bead along designated sealant channel.

EXTERNAL SEALING - Slowly apply a 3/8" to 1/2" rounded bead along exterior log seams. If possible, wait 12 to 18 months after the structure is built before caulking log seams. Apply around windows, doors, upward facing cracks, etc. Let the pressure of the gun force Puttylastic deep into the openings to be sealed.

SHelf LIFE - Two years when stored under normal conditions.

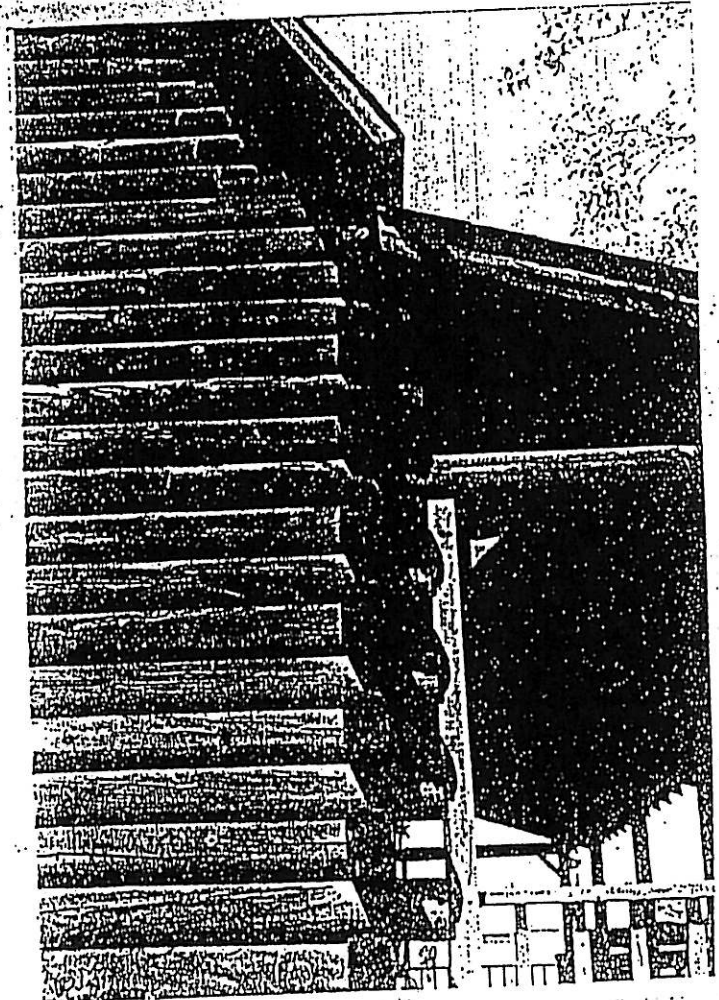
COVERAGE - Approximately 20 lineal feet per 1/10 gallon tube, 200 lineal feet per gallon with 1/4-inch bead.

PHYSICAL PROPERTIES

WEIGHT PER GALLON:	Approximately 8.80 lbs./gallon
FULL BODY VISCOSITY:	335-365 MM on Penetrometer at 77°F
SOLIDS BY WEIGHT:	88.60%
FLASH POINT:	102°F
DRY TIME:	At 1/2-inch round bead, a slight skin will form within 24 hours.



UPPER PHOTO: View of the gabled end of the house showing the configuration of the logs and gambrel roof. The majority of the leaks are coming in through the gabled end walls.



LOWER PHOTO: View of the corner of the house showing the interconnection of the logs. Many of the ends of the logs show large checks.

PRODUCT DATA

PUTTYLASTIC LOG HOME CONSTRUCTION CAULK "The Soft Seal"

Formula Numbers

55-991CS - Natural Bronze

PURPOSE - An internal construction sealant applied between the logs during the stacking of log walls.

DESCRIPTION - Puttylastic is an excellent, all-weather construction caulk. Unlike other caulks, it is not as sensitive to adverse weather conditions, has better tube stability, and possesses qualities that are more suited to the unique nature of log homes. Puttylastic is designed to "cure" extremely slow. Its distinguishing feature is its ability to provide a soft, fluid, seal that can more readily adjust to and absorb the multiple forces and tensions exerted by log movement. It will form a "skin" within 48 hours and remain soft to touch for an indefinite period of time.

SURFACE PREPARATION - Surface must be clean, sound and dry.

APPLICATION - Apply Puttylastic with a caulking gun. Use on dry, calm moderate days.

INTERNAL SEALING - (between the logs) - for best results, a caulking tolerance of at least 1/8" should be engineered in the log design. Apply a 3/8" to 1/2" rounded bead along designated sealant channel.

EXTERNAL SEALING - Slowly apply a 3/8" to 1/2" rounded bead along exterior log seams. If possible, wait 12 to 18 months after the structure is built before caulking log seams. Apply around windows, doors, upward facing cracks, etc. Let the pressure of the gun force Puttylastic deep into the openings to be sealed.

SHELF LIFE - Two years when stored under normal conditions.

COVERAGE - Approximately 20 lineal feet per 1/10 gallon tube, 200 lineal feet per gallon with 1/4-inch bead.

PHYSICAL PROPERTIES

WEIGHT PER GALLON: Approximately 8.80 lbs./gallon

FULL BODY VISCOSITY: 335-365 MM on Penetrometer at 77°F

SOLIDS BY WEIGHT: 88.60%

FLASH POINT: 102°F

DRY TIME: At 1/2-inch round bead, a slight skin will form within 24 hours.

RECEIVED

GENERAL NOTES AND RECOMMENDATIONS

EXHIBIT F

ALL DETAILS SHOWN ON PAGES D-2 THRU D-6 MAY NOT PERTAIN TO THIS PARTICULAR BUILDING, SPECIFIC NUMBERED PLANS SHOULD BE CONSULTED.

THE BUILDER AND CUSTOMER MUST DETERMINE THAT ALL CONSTRUCTION CONFORMS TO LOCAL CODES AND ACCEPTED BUILDING PRACTICES.

CARE SHOULD BE TAKEN TO INSURE THAT VULNERABLE MATERIALS ARE PROTECTED FROM THE ELEMENTS. OTHERWISE, TWISTING AND WARPAGE WILL OCCUR.

- INSUFFICIENT CAULKING AND/OR FAILURE TO USE GASKET MATERIAL MAY RESULT IN AIR PENETRATION THROUGH THE LOG WALLS AS THEY DRY AND SETTLE.
- 1. THE CORNERS AND BUTT JOINTS MUST BE TIGHT, SPLINES SHOULD BE USED AT ALL LOG SPLICES. BUILDING DIMENSIONS SHOULD BE KEPT AS NOTED ON THE PLANS.
- 2. DO NOT SCALE THE PRINTS TO DETERMINE A PARTICULAR DIMENSION -- USE MEASUREMENTS SHOWN.
- 3. INTERIOR DOORS ARE TO BE HUNG ON THE JOB. THE BUILDER MUST SUPPLY JAMBS.
- 4. THE KNOTTY PINE MATERIAL SUPPLIED FOR CEILINGS, WALLS, ROOF FLOORS (WHERE APPLICABLE) IS NOT KILN DRIED. CARE SHOULD BE TAKEN IN ITS USE AS SHRINKING AND SUBSEQUENT SEPARATION MAY OCCUR AFTER INSTALLATION WHERE DRY HEAT FURTHER REDUCES THE MOISTURE CONTENT OF THE WOOD. PROPER HUMIDITY CONTROL IS NECESSARY TO AVOID UNDESIRABLE SHRINKAGE.
- 5. PANEL ALL EXPOSED WALLS FIRST. THEN USE REMAINDER OF PANEL FOR CLOSETS, BEHIND KITCHEN CABINETS, ETC.
- 6. AS INDICATED IN OUR LITERATURE, WE DO NOT APPLY A WOOD PRESERVATIVE TO THE LOG MATERIAL. WE DO, HOWEVER, RECOMMEND THAT A PROPER PRESERVATIVE SUBSTANCE BE APPLIED TO PREVENT WATER PENETRATION THROUGH THE WALLS. USE EXTREME CARE IN APPLYING THIS MATERIAL AND FOLLOW ALL DIRECTIONS FROM THE MANUFACTURER.