

EA02-025

FORD 10/27/03

LETTER TO ODI

APPENDIX M

BOOK 16 OF 22

PART A-D

PART C

466392

SNORTON1
TX

CC/62

2002-025-R 19708

State Farm Insurance Companies



P.O. Box 41388
Houston, Tx 77241
Phone (713) 895-2200

July 16, 2002

Ford Motor Company
3 Parklane Blvd. Ste. 300
Dearborn, Michigan 48126-2568

RE: Claim Number: [REDACTED]
Date of Loss: June 21, 2002
Our Insured: [REDACTED]

Dear Shawn Norton:

Enclosed please find the answers to your questions: 1. 6-21-02 Houston, Texas. 2. The brake pressure switch caught on fire while the vehicle was parked in the garage at 8:00 p.m. 3. See attached. 6. 123,000 miles. 7. See attached. 10. Brake pressure switch (cruise control deactivation switch) caught on fire. 11. See attached. 12. No. 13. BCAP: 281-443-1300 stock number: 2019249. 14. See attached. 15. Burned in the fire. 16. None. 21. No 22. No. 23. The vehicle was a program car purchased in Aug. or Sept. of 1994 from Texas City Lincoln. The insured did not know the actual mileage.

Sincerely,

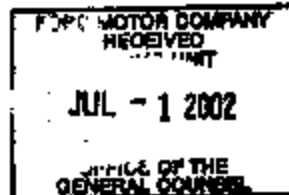

John Gigl
Claim Processing Specialist
(713) 895-3330

State Farm Mutual Automobile Insurance Company

State Farm Insurance Companies®



June 26, 2002



Northwest Freeway Service Center
8707 North Gessner Drive
Houston, Texas 77040-4084

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Ford Motor Company
Parklane Towers West, Suite 400
Three Parklane Blvd.
Dearborn, MI 48126-2588

Re: Claim Number: [REDACTED]
Our Insured: [REDACTED]
Date of Loss: June 21, 2002
Make, Model, and Year of Vehicle: 1994 Lincoln Town Car
VIN: 1LNLM81W5RY633478

Dear Sir or Madam:

State Farm Mutual Automobile Insurance Company insures the identified vehicle listed above. This vehicle experienced a fire in the engine compartment.

State Farm® would like to give you an opportunity to inspect the vehicle and give you an advanced notice of our potential subrogation claim.

Please contact me at (713) 895-2272 to set up a time for your inspection.

Sincerely,


Tammy Morrison
Senior Claim Representative
State Farm Mutual Automobile Insurance Company
(713) 895-2272

TN/mlb/044/0826020

REDACTED

Confidential Fire Report

RE:

[REDACTED]
Houston, Texas
Harris County
DOL: June 21, 2002
Policy #:
Claim #:

TO:

Brandon Sturm
Claim Representative
State Farm Insurance Company
P. O. Box 41369
Houston, Texas 77241
6707 North Gessner
Houston, Texas 77240
Office: 713.895.2221
Fax: 713.895.2250

Tammy Morrison
State Farm Insurance Company
1994 Lincoln Towncar
Claim #: 43R963110
Office: 713.895.2272

FROM:

INTROSPECT
License #: C-4800
1023-C 3rd Street
League City, Texas 77573
Office: 281/332-0613
Facsimile: 281/332-0842

DATE:

June 25, 2002

RECEIVED

JUL 16 2002

NORTHWEST FREEWAY CSO

ER02-025-A 10700

INTRODUCTION

June 24, 2002, Monday, Kathy Grafton, State Farm Insurance Company requested a Fire Origin and Cause Evaluation of the above captioned loss. The scene investigation was scheduled for June 25, 2002, Tuesday between 9:00 and 10:00 a.m.

DETAILS

June 25, 2002, Tuesday, approximately 09:30 hours Doug Holmes and Lloyd Young arrived at the fire scene.

Approximately 16:30 hours the fire scene evaluation was completed for the day.

RECEIVED

JUL 16 2002

NORTHWEST FREEWAY C90

BR62-628-A 18718

SCENE SUMMARY

The structure is a 1-story, wood-frame, single-family residence. The structure faces approximately 360° magnetic north.

DESCRIPTION OF STRUCTURE:

The roof was composition over wood decking.

The siding was brick.

The foundation was concrete slab.

The residence was built in approximately 1972.

The house was sub-divided as follows:

- **4 Bedrooms**

Floor: Carpet and pad
Walls: Sheetrock
Ceiling: Sheetrock

- **2 ½ BATHROOMS**

Floor: Vinyl Tile
Walls: Sheetrock [Wood paneling over sheetrock in the ½ bathroom.]
Ceiling: Sheetrock

- **LIVING ROOM**

Floor: Carpet and pad
Walls: Sheetrock
Ceiling: Sheetrock

RECEIVED

JUL 16 2002

NORTHWEST FREEWAY C80

EA02-025-A 10711

- **KITCHEN**
 Floor: Vinyl tile
 Walls: Sheetrock
 Ceiling: Sheetrock

- **DEN**
 Floor: Vinyl tile
 Walls: Wood panelling
 Ceiling: Sheetrock

- **BREAKFAST NOOK**
 Floor: Vinyl tile
 Walls: Sheetrock/Wood panelling
 Ceiling: Sheetrock

- **DINING ROOM**
 Floor: Carpet and pad
 Walls: Sheetrock
 Ceiling: Sheetrock

- **UTILITY ROOM**
 Floor: Vinyl tile
 Walls: Sheetrock/Wood panelling
 Ceiling: Sheetrock

- **FOYER**
 Floor: Vinyl tile
 Walls: Sheetrock
 Ceiling: Sheetrock

- **HALL**
 Floor: Carpet and pad
 Walls: Sheetrock
 Ceiling: Sheetrock

The ceiling contained Fiberglas insulation [6 1/4"].

The attic access was located in the hallway in front of the master bedroom. It was a drop-type wooden stairway.

GARAGE: The garage was attached by a breezeway. The breezeway allowed the products of combustion to spread from the garage into the common attic of the residence.

The garage contained two single metal garage doors. There was an automatic garage door-opener above the 1994 Lincoln Towncar. The device was a victim of the fire.

The walls of the garage were exposed studs.

The ceiling was exposed wooden joists.

FIRE SCENE RECONSTRUCTION: *[The process of recreating the physical scene during fire scene analysis through the removal of debris and the replacement of contents or structural elements in their pre-fire positions.] [NFPA 921-1-3, 11-7; NFPA 1033-3-2.8.2; NFPA Handbook]*

The fire scene reconstruction allowed investigators to see the fire patterns on the exposed surfaces and make a more accurate origin analysis. *[NFPA 921-11-7]*

The two mattresses were repositioned with the assistance of the insured, [REDACTED]. The fire scene was intact with the exception of the mattresses.

UTILITIES

ELECTRICITY: Reliant Energy/HL&P provides the electric service for the loss. The Westinghouse electric meter (Serial #56.365.130) displayed "8-7-9-4-7" at the time of the evaluation.

The electric service entered the dwelling approximately ten feet west of the southeast corner of the structure.

The branch wiring in the structure consists of copper wiring.

An interior breaker box is located on the south wall.

The circuit breakers are in the following positions (upper-left to lower-right):

	Ampere	Type	Position
MAIN:	Unknown	Double	OFF
01>	15	Single	OFF
02>	20	Single	OFF
03>	20	Single	TRIPPED
04>	20	Single	OFF
05>	60	Double	OFF
06>	15	Single	OFF
07>	15	Single	OFF
08>	20	Single	OFF

09>	20	Single	OFF
10>	15	Single	OFF
11>	15	Single	OFF
12>	20	Single	TRIPPED
13>	15	Single	OFF

DOMESTIC GAS: The domestic gas service is provided by Riant Energy/Entax. The Sprague brand meter (Serial #4570796) is located on the east exterior wall. The meter reading at the time of inspection is "6-8-3-8". The meter is reported to have been "ON" at the time of the loss.

There was no domestic gas service within the garage. There was no evidence of fugitive gas anomaly such as a low-order explosion or flash fire.

<<<>>>

WATER HEATER: The Rheem, 40- gallon, gas fueled water heater is located in the northwest corner of the Utility Room. The control is in the "ON" position. The gas valve is in the "OPEN" position.

Fire patterns, witnesses, and/or chemistry and physics of fire eliminated the water heater as a fire cause.

<<<>>>

HVAC: The horizontal furnace is located in the attic near the drop-stairway. The thermostat is located in the hallway. At the time of the fire, the "mode" switch is in the "COOL" position, and the fan switch is in the "AUTO" position. The return air is located in the hallway across from the master bathroom.

Fire patterns, witnesses, and/or chemistry and physics of fire eliminated the water heater as a fire cause.

<<<>>>

SMOKE DETECTORS: There was no evidence of a smoke detector.

SECURITY SYSTEMS: The structure was not protected by a security system.

FORCED ENTRY: The fire department forced entry as follows:

- Vehicle trunk.
- Garage passage door.
- Residence door.

CASUALTIES

None reported.

1992-025-A 18717

EVIDENCE

June 25, 2002, Tuesday, a series of color photographs were taken by Doug Holmes and Lloyd Young.

< < < > > >

June 25, 2002 a color videotape reproduction of the scene was taken by Lloyd Young and Doug Holmes.

E002-025-A 10710

FIRE ORIGIN and CAUSE

[NFPA 921/ 921/1033]

FIRE CAUSE: The cause of this fire is **ACCIDENTAL**.

FIRE ORIGIN: The area of origin of the fire is located in the engine compartment of the 1994 Lincoln Towncar. The point of origin is the "Cruise Control Brake Disable Switch".

IGNITION SEQUENCE:

Equipment Involved in Ignition: Cruise Control Brake Disable Switch. [Texas Instruments]

Form of Heat of Ignition: Electrical arcing.

Source of Heat of Ignition: 12-volt battery energy at the point of origin.

Ignition Factor: The Cruise Control Brake Disable Switch sealer degraded allowing the energized switch to ignite leaking brake fluid.

MATERIAL IDENTIFICATION: [REDUCING AGENT]

Form: Sealer

Type: "Dupont" [E. L. Dupont DeNemours] Sealer.

EX-201 RPT.

ERG2-025-A 10710

FIRE DYNAMICS: [FIRE MOVEMENT]

Materials: Sealer

Avenues: The fire burned inside the passenger side of the engine compartment spreading throughout the engine compartment. The fire then spreads upwards and outward to the ceiling and walls of the garage.

SMOKE DYNAMICS: [PRODUCTS OF COMBUSTION]

Materials: Sealer, ignitable liquids, oil residue.

Avenues: The smoke spread throughout the garage and into the house via the attic of the breezeway.

THERMAL CAUSATION HYPOTHETICALS (HEAT SOURCES):

Utilizing the scientific method, the following heat sources were considered and eliminated due to burn patterns, observation of witnesses, fire chemistry, fire physics, arc mapping, and/or damage analysis:

Discarding smoking materials

Electrical distribution malfunctions

Appliance malfunction

Children playing with matches

Incendiary

EXPLOSION: There was no documentary, demonstrative, or physical evidence of an explosion observed during our investigation of the loss.

In conclusion, all other accidental, natural, and incendiary fire causes have been eliminated.

VEHICLE INFORMATION

1994 Mercury Lincoln Towncar
VIN#: 1LNLM81W5RY633476

Temple, Texas
Vehicle Weight: 4000#

Doug Holmes interviewed [REDACTED] who advised the following:

There were no previous fires reported in the vehicle.

- **The car contained the following accessories:**
 - **Cruise Control**
 - **Power Windows**
 - **Power Locks**
 - **Automatic Transmission**
 - **Cassette Tape/Radio**
- **My wife drove the vehicle on the afternoon before the fire.**
- **The amount of fuel is unknown.**
- **The last repair to the vehicle was made to the rear air bags.**
- **The fire department attempted to force entry into the trunk.**
- **The fuel cap was in position. The fuel door was closed.**
- **The following systems were examined and eliminated:**

- The exhaust system
 - Ignition
 - Fuel system
 - Emission System
 - Power Steering
 - Transmission
 - Rear end
 - Lube
 - Cooling System
- The vehicle title was photographed by Doug Holmes
 - The Shifting Lever was in the "Parked" Position
 - Parking Brake was not engaged
 - Windows were up

FIRE ORIGIN

The determination of the origin of this fire involved the coordination of information derived from the recognition, identification, interpretation, and correlation of validated burn patterns; observations of witnesses; and an analysis of the chemistry and physics of the fire. (NFPA 921-01-15-1)

BURN PATTERNS

Fire patterns are the visible or measurable physical effects that remain after a fire. (NFPA 921-01-4-3)

[01] BURN UNDER DOOR. *When a door is closed on a fire, hot gases (being lighter) can escape through the space at the top of a closed door, resulting in charring. Cool air may enter the compartment at the bottom of the door. In a fully developed room fire where the hot gases extend to the floor, the hot gases may escape under the door and cause charring under the door and possibly through the threshold. This can also occur if glowing debris falls against the door either on the inside or the outside. (NFPA 921-01-4-2-2; 4-2-2 [b]).*

The above captioned burn pattern was not observed.

[02] HOLES BURNED THROUGH THE FLOOR. *Holes in floors may be caused by glowing combustion, radiation, or an ignitable liquid. Because the surface below a liquid remains cool (or at least below the boiling point of the liquid) until the liquid is consumed, holes in the floor from burning ignitable liquids may result when the ignitable liquid has soaked into the floor or accumulated below the floor level. Evidence other than the hole or its shape is necessary to confirm the cause of a given pattern. (NFPA 921-01-4-2.2; 4-2.4; 4-3.3; 4-16.1.4; 4-17.7.2)*

The above captioned burn pattern was not observed.

[03] HOT GAS LAYER GENERATED. *The radiant flux from the overhead hot gas layer can produce damage to the upper surfaces of contents and floor covering materials. This commonly begins as the environment within the room approaches flashover conditions. Similar damage to floor surfaces from radiant heat frequently occurs in adjacent spaces outside rooms that are fully involved in fire. Damage to hallway floors and porches are examples. If the fire does not progress to full room involvement, the damage may include blistering, charring, or melting. Protected surfaces may exhibit no damage. At this time in the fire development, a line of demarcation representing the lower extent of the hot gas layer may form on vertical surfaces. The degree of damage generally will be uniform except where there is drop down, burning of isolated items that are easily ignited, or protected areas. Damage to the undersides of furnishings below the bottom of the hot layer is unlikely. (NFPA 921-01-4-2.3)*

The above captioned burn pattern was not observed.

[04] CHARRING THE UNDERSIDES OF FURNITURE. *If a fire progresses to full room involvement, damage found at low levels in the room down to and including the floor can be more extensive due to the effects of high radiative flux and the convected heat from the descending hot gas layer. Damage can include charring of the undersides of furniture, burning of carpet under furniture, uniform burning around table legs, burning of baseboards and the undersides of doors, and burning on floor covering in corners. Holes can be burned through carpet and floors. (NFPA 921-01-4-2.4)*

The above captioned burn pattern was not observed.

[05] BURNING OF CARPET UNDER FURNITURE. *If a fire progresses to full room involvement, damage found at low levels in the room down to and including the floor can be more extensive due to the effects of high radiative flux and the convected heat from the descending hot gas layer. Damage can include charring of the undersides of furniture, burning of carpet under furniture, uniform burning around table legs, burning of baseboards and the undersides of doors, and burning on floor covering in corners. Holes can be burned through carpet and floors. (NFPA 921-01-4-2.4)*

The above captioned burn pattern was not observed.

[06] UNIFORM BURNING AROUND TABLE LEGS. *If a fire progresses to full room involvement, damage found at low levels in the room down to and including the floor can be more extensive due to the effects of high radiative flux and the convected heat from the descending hot gas layer. Damage can include charring of the undersides of furniture, burning of carpet under furniture, uniform burning around table legs, burning of baseboards and the undersides of doors, and burning on floor covering in corners. Holes can be burned through carpet and floors. (NFPA 921-01-4-2.4)*

The above captioned burn pattern was not observed.

[07] BURNING OF BASEBOARDS. *If a fire progresses to full room involvement, damage found at low levels in the room down to and including the floor can be more extensive due to the effects of high radiative flux and the convected heat from the descending hot gas layer. Damage can include charring of the undersides of furniture, burning of carpet under furniture, uniform burning around table legs, burning of baseboards and the undersides of doors, and burning on floor covering in corners. Holes can be burned through carpet and floors. (NFPA 921-01-4-2.4)*

The above captioned burn pattern was not observed.

[08] BURNING OF FLOOR COVERING IN CORNERS. *If a fire progresses to full room involvement, damage found at low levels in the room down to and including the floor can be more extensive due to the effects of high radiative flux and the convected heat from the descending hot gas layer. Damage can include charring of the undersides of furniture, burning of carpet under furniture, uniform burning around table legs, burning of baseboards and the undersides of doors, and burning on floor covering in corners. Holes can be burned through carpet and floors. (NFPA 921-01-4-2.4)*

The above captioned burn pattern was not observed.

[09] CHARRING *Is the carbonaceous material that has been burned and has a blackened appearance.*

Many surfaces are decomposed in the heat of a fire. The binder in paint will char and darken the color of the painted surface. Wallpaper and the paper surface of gypsum wallboard will char when heated. Vinyl and other plastic surfaces on walls, floors, tables, or counters also will discolor and char. Wood surfaces also will char, but, because of the greater significance of wood char, it is being treated in greater detail in 4-5.1 through 4-5.5.

The degree of discoloration and charring can be compared to adjacent areas to find the areas of greatest burning.

Charred wood is likely to be found in nearly all structural fires. When exposed to elevated temperatures, wood undergoes chemical decomposition that drives off gases, water vapor, and various pyrolysis products as smoke. The solid residue that remains is mainly carbon. Char shrinks as it forms, and develops cracks and blisters.

Analysis of the depth of charring is most reliable for evaluating fire spread, rather than for the establishment of specific burn times or intensity of heat from adjacent burning materials. (NFPA 921-01-1-3, 4-5.1 - 4-5.5.)

The above captioned burn pattern was observed.

[10] CONSUMPTION OF COMBUSTIBLES. *Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effects. (NFPA 921-01-4-3)*

The above captioned burn pattern was observed.

[11] CHANGES IN COLOR. *Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effects.*

Combustible surfaces will be darkened by the beginnings of pyrolysis, be burned, or be in various stages of charring, including the total loss of material. Noncombustible surfaces, such as mineral materials or metals, may exhibit color changes, oxidation, physical distortions, or melting.

Other circumstances and effects that may be considered along with analyzing the springs include the loss of mass and material or depth of char to the frame if constructed of wood. Similar analysis may also include color changes, possibly indicating intensity, in metal frames. Still other effects for comparative analysis include considerations of the covering material of the springs. The absence of material may indicate that the portion closer to the source of heat, while the presence of materials may indicate an area more remote from the heat source. (NFPA 921-01-4-3, 4-14)

The above captioned burn pattern was observed.

[12] CHANGES IN CHARACTER. *Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effect. (NFPA 921-01-4-3)*

The above captioned burn pattern was observed.

[13] STRUCTURAL COLLAPSE. *The evidentiary and interpretative value of fire patterns may be as valuable as the identification of a potential ignition source, such as an incendiary device in an arson fire or an appliance in an accidental fire. Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effects. (NFPA 921-01-4-3; 9-3.1)*

The above captioned burn pattern was not observed.

[14] PENETRATION OF HORIZONTAL SURFACES. *Penetration of horizontal surfaces, from above or below, can be caused by radiant heat, direct flame impingement, or localized smoldering with or without the effects of ventilation.*

Penetrations in a downward direction are often considered unusual because the more natural direction of heat movement is upward through the action of buoyancy. In fully flashed over compartments, however, hot gases may be forced through small, pre-existing openings in a floor, resulting in a penetration. Penetrations may also arise as the result of intense burning under furniture items such as polyurethane mattresses, couches, or chairs. Flaming or smoldering under collapsed floors or roofs can also lead to floor penetrations. Downward penetration, such as a hole burned into a floor or tabletop, may need to be noted and analyzed by the investigator. (NFPA 921-01-4-3.3)

The above captioned burn pattern was observed.

[15] SLOPING SIDES OF A BURNED HOLE. *Whether a hole burned into a horizontal surface was created from above or below may be identified by an examination of the sloping sides of the hole. Sides that slope downward from above toward the hole are indicators that the fire was from above. Sides that are wider at the bottom and slope upward toward the center of the hole indicate that the fire was from below. (NFPA 921-01-4-3.3)*

The above captioned burn pattern was not observed.

[16] MOVEMENT TYPE BURN PATTERNS. *Flame and heat movement patterns are produced by the growth and movement of fire and the products of combustion away from an initial heat source. If accurately identified and analyzed, these patterns can be traced back to the origin of the heat source that produced them. (NFPA 921-01-4-4.1)*

The above captioned burn pattern was observed.

[17] INTENSITY TYPE BURN PATTERNS. *Flame and heat intensity patterns are produced by the response of materials to the effects of various intensities of heat exposure. The various heat effects on a certain material can produce lines of demarcation. These lines of demarcation may be helpful to the investigator in determining the characteristics and quantities of fuel materials, as well as the direction of fire spread. (NFPA 921-01-4-4.2)*

The above captioned burn pattern was observed.

[18] DEPTH OF CHAR. *Analysis of the depth of charring is most reliable for evaluating fire spread, rather than for the establishment of specific burn times or intensity of heat from adjacent burning materials. By measuring the relative depth and extent of charring, the investigator may be able to determine what portions of a material or construction were exposed the longest to a heat source. The relative depth of char from point to point is the key to appropriate use of charring - locating the places where the damage was most severe due to exposure, ventilation, or fuel placement. The investigator may then deduce the direction of fire spread, with decreasing char depths being farther away from the heat source. (NFPA 921-01-4-5.3)*

The above captioned burn pattern was observed.

[19] FUEL GAS DEPTH OF CHAR. *When fugitive fuel gases are the initial fuel sources for fires, they produce relatively even depths of char over the often wide areas that they cover.*

Progressive changes in depth of char that are used by investigators to trace fire spread may exist only in those areas to which the fire spreads from the initial locations of the pocketed fuel gases.

Deeper charring may exist in close proximity to the point of gas leakage, as burning may continue there after the original quantity of gas is consumed. This charring may be highly localized because of the pressurized gas jets that can exist at the immediate point of leakage and may assist the investigator in locating the leak. (NFPA 921-01-4-5.4)

The above captioned burn pattern was not observed.

[20] SPALLING. *Spalling is the breakdown in surface tensile strength of concrete, masonry, or brick caused by exposure to high temperatures and rates of heating resulting in mechanical forces within the material. These forces are believed to result from one or more of the following:*

- (a) Moisture present in uncured or "green" concrete*
- (b) Differential expansion between reinforcing rods or steel mesh and the surrounding concrete*
- (c) Differential expansion between the concrete mix and the aggregate (This is most common with silicon aggregates.)*
- (d) Differential expansion between the fine grained surface finished layers and the coarser grained interior layers*
- (e) Differential expansion between the fire exposed surface and the interior of the slab*

Spalling of concrete or masonry surfaces may be caused by heat, freezing chemicals, or abrasion. It may be more readily induced in poorly formulated or finished surfaces. Spalling is characterized by distinct lines of striation and the loss of surface material resulting in cracking, breaking, and chipping or in the formation of craters on the surface.

Spalling of concrete, masonry, or brick has often been linked to unusually high temperatures caused by burning accelerant. While spalling can involve high rates of heat release or a rapid change in temperature, an accelerant need not be involved. The primary mechanism of spalling is the expansion or contraction of the surface while the rest of the mass expands or contracts at a different rate. Spalled areas may appear lighter in color than adjacent areas. This lightening can be caused by exposure of clean subsurface material. Adjacent areas may also tend to be sooted.

Another factor in the spalling of concrete is the loading and stress in the material at the time of the fire. Since these high-stress or high-load areas may not be related to the fire location, spalling of concrete on the underside of ceilings or beams may not be directly over the origin of the fire.

Spalling of concrete at a fire scene has been, in the past, thought to be a positive indicator of a liquid accelerant-involved fire. The rapid cooling of a heated mass of concrete, brick, or masonry can also cause spalling. A common source of rapid cooling in a fire situation is extinguishment by water.

The presence or absence of spalling at a fire scene should not, in and of itself, be construed as an indicator of the presence or absence of liquid fuel accelerant. The presence of ignitable liquids will not normally cause spalling beneath the surface of the liquid. The ability of the surface to absorb or hold the liquid may be a factor in the production of spalling, especially on horizontal surfaces such as concrete floors. For example, a painted or sealed concrete floor is unlikely to spall. Rapid and intense heat development from an ignitable liquid fire may cause spalling on adjacent surfaces, or a resultant fire may cause spalling on the surface after the ignitable liquid burns away.

Since spalling can occur from sources other than fires, it is desirable to determine whether spalling was present prior to the fire. Overall, it should be noted that the importance of spalling to the fire investigator lies in the documentation and analysis of a heat source. (NFPA 921-01-4-6)

The above captioned burn pattern was not observed.

[21] OXIDATION. *Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effects.*

Oxidation is the basic chemical process associated with combustion. Oxidation of some materials that do not burn can produce lines of demarcation and fire patterns of use to fire investigators. Oxidation for these purposes may be defined as a combination of oxygen with substances such as metals, rock, or soil that is brought about by high temperatures.

The effects of oxidation include change of color and change of texture. The higher the temperature and the longer the time of exposure, the more pronounced the effects of oxidation will be. Bare galvanized steel with mild heating will get a dull whitish surface from oxidation of the zinc coating. This oxidation also eliminates the protection that the zinc gave the steel. If the unprotected steel is wet for some time, it will then rust. Thus there can be a pattern of rusted compared to nonrusted galvanized steel.

When uncoated iron or steel is oxidized in a fire, the surface first gets a blue-gray dullness. Oxidation can proceed to thick layers of oxide that can flake off. After the fire, if the metal has been wet, the usual rust-colored oxide may appear.

On stainless steel surfaces, mild oxidation can give color fringes, and severe oxidation will give a dull gray color.

Copper forms a dark red or black oxide when exposed to heat. The color is not significant. What is significant is that the oxidation can form a line of demarcation. The thickness of the oxide can show greater fire conditions. The more it is heated, the greater the oxidation. These color changes can form lines of demarcation. Burn patterns created on metal appliance cabinets may be helpful in determining fire origin and direction of travel. Rocks and soil when heated to very high temperatures will often change colors that may range from yellowish to red.

Soot and char are also subject to oxidation. The dark char of the paper surface of gypsum wallboard, soot deposits, and paint can be oxidized by continued exposure to fire heat. The carbon will be oxidized to gases and disappear from whatever surface it was on. This will result in what is known as clean burn. (NFPA 921-01-4-3; 4-7)

The above captioned burn pattern was observed.

[22] MELTING OF MATERIALS. *Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effects.*

The melting of a material is a physical change from a reaction caused by heat. The border between the melted and solid portions of a fusible material can produce lines of heat and temperature demarcation that the investigator can use to define fire patterns.

Many solid materials soften or melt at elevated temperatures ranging from a little over room temperature to thousands of degrees. A specific melting temperature or range is characteristic for each material.

Melting temperatures of common metals range from as low as 338°F to 370°F (170°C to 188°C) for solder to as high as 2660°F (1460°C) for steel. When the metals or their residues are found in fire debris, some inferences concerning the temperatures in the fire can be drawn.

Thermoplastics melt at rather low temperatures ranging from around 200°F (93°C) to near 750°F (400°C). They can also be consumed in a fire. Thus, the melting of plastics can give information on temperatures but mainly where there have been hot gases but little or no flame in that immediate area.

Glass melts or softens over a range of temperatures. Nevertheless, glass can give useful information on temperatures during a fire. (NFPA 921-01-4-3; 4-8)

The above captioned burn pattern was observed.

[23] TEMPERATURE DETERMINATION. *If the investigator knows the approximate melting temperature of a material, an estimate can be made of the temperature to which the melted material was subjected. This knowledge may assist in evaluating the intensity and duration of the heating, the extent of heat movement, or the relative rates of heat release from fuels.*

When using such variable materials as glass, plastics, and white pot metals for making temperature determinations, the investigator is cautioned that there are a wide variety of melting temperatures for these generic materials. The best method when utilizing such materials as temperature indicators is to take a sample of the material and have its melting temperature ascertained by a competent laboratory, materials scientist, or metallurgist.

Wood and gasoline burn at essentially the same flame temperature. The flame temperatures achieved by all hydrocarbon fuels (plastics and ignitable liquids) and cellulosic fuels are approximately the same, although the fuels release heat at different rates.

The temperature achieved by an item at a given location within a structure or fire area depends on how much it is heated. The amount of heating depends on the temperature and velocity of the airflow, the geometry and physical properties of the heated item, its proximity to the source of heat, and the amount of heat energy present. Burning metals and highly exothermic chemical reactions can produce temperatures significantly higher than those created by hydrocarbon- or cellulosic-fueled fires.

Identifiable temperatures achieved in structural fires rarely remain above 1900°F (1040°C) for long periods of time. These identifiable temperatures are sometimes called "effective fire temperatures," for they reflect physical effects that can be defined by specific temperature ranges. The investigator can use the analysis of the melting and fusion of materials to assist in establishing whether higher than expected heat energy was present. (NFPA 921-01-8.1)

The above captioned burn pattern was observed.

[24] ALLOYING. The melting of certain metals may not always be caused by fire temperatures higher than the metals' stated melting point. It may be caused by alloying.

During a fire, a metal with a relatively low melting point may drip onto other metals that do not often melt in fires. This phenomenon can also occur when component parts of a heated object are in contact with each other. If the lower-melting-temperature metal can mix with the higher-melting-temperature metal, that mixture (alloy) will melt at a temperature less than the melting temperature of the higher-melting-temperature metal and in some cases less than that of either metal. Examples of relatively low-melting-temperature metals are aluminum, zinc, and lead. Metals that can be affected by alloying include copper and iron (steel). Copper alloying is often found, but iron (steel) alloying might be found in only a few cases of sustained fire.

Copper wiring and tubing or piping are often affected by alloying. Drips of low-melting-temperature metal may simply stick to the surface if the heating has been brief. With further heating the low-melting-temperature metal will wet the surface and begin to mix. Aluminum can mix through the wire or wall of the tubing to give a yellow alloy at about 10 percent aluminum, but that is not often found. More commonly the aluminum will mix in higher proportions and give a brittle silvery alloy. The surface of the spot of aluminum on the surface of the copper may appear gray, and the surface may be fairly dark near the copper-aluminum interface. Copper that has been alloyed with aluminum will be very brittle. For example, bending copper wire at the point of alloying will likely cause it to break there.

When zinc alloys with copper, a yellowish brass will result. Because zinc is less common in buildings than aluminum, zinc alloying is not often encountered.

Alloys do not form readily with steel in fires. However, if aluminum or zinc is heated for a long time with a steel object, that object may develop pits or holes from alloying.

If fire evidence containing aluminum-alloyed copper is exposed to weather, the alloy may corrode away, leaving neat holes in tubing or blunt ends on wires. Those edges will not have the appearance of melting.

Alloying may be confirmed by metallurgical analysis, and the alloy may be identified. When metals with high melting temperatures are found to have melted due to alloying, it is not an indication that accelerants or unusually high temperatures were present in the fire. (NFPA 921-01-4-8.2)

The above captioned burn pattern was not observed.

[25] THERMAL EXPANSION & DEFORMATION. *Many materials change shape temporarily or permanently during fires. Nearly all common materials expand when heated. That can affect the integrity of solid structures when they are made from different materials. If one material expands more than another material in a structure, the difference in expansion can cause the structure to fail.*

The bending of steel beams and columns in a fire above about 1000°F (538°C) is caused by the progressive loss of strength of the steel. The more the load on any unrestrained steel object, the more will be the deformation for a given time and temperature. Bending is not a matter of melting. Thermal expansion can also be a factor in the bending of the beam, if the ends of the beam are restrained.

Plastered surfaces are also subject to thermal expansion. Locally heated portions of plaster walls and ceilings may expand and separate from their support lath. This breaking away of the plaster can produce lines or areas of heat demarcation displaying V patterns, U patterns, and truncated cone patterns. (NFPA 921-01-4-9)

The above captioned burn pattern was observed.

[26] SMOKE AND SOOT DEPOSITS. *Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effect.*

Fuels that contain carbon can form soot in their flames. Petroleum products and most plastics form soot most readily. When flames touch walls and ceilings, soot will commonly deposit. A specific deposit shows where there has been a particular fuel load. Soot also deposits on surfaces by settling. Such general soot deposits show merely that soot formed nearby but do not indicate the specific source.

Smoke and soot can collect on cooler surfaces of a building or its contents, often on upper parts of walls in rooms adjacent to the fire. Smoke, especially from smoldering fires, tends to condense on walls, windows, and other cooler surfaces. Because deposits of pyrolysis products tend to be widely distributed, they do not help locate the exact point of origin.

Smoke condensates are shades of brown whereas soot is black. Smoke condensates can be wet and sticky, thin or thick, or dried and resinous. These deposits, after drying, are not easily wiped off. Where there has been open flame, the deposits will likely be a mixture of soot and smoke. When smoke deposits are subsequently heated in a fire, the brown deposit may be changed in color, texture, and composition and may become darker or charred.

Some fires might produce only dry soot deposits that wipe easily from windows or other surfaces. Floors and top surfaces of contents often get a coating of soot that settles on them during and after sooty fires.

Both the carbonized smoke deposit and soot deposits can be burned off of windows or other surfaces by prolonged exposure to fire.
(NFPA 921-01-4-3; 4-10)

The above captioned burn pattern was observed.

[27] CLEAN BURN. *Clean burn is a phenomenon that appears on noncombustible surfaces when the soot and smoke condensate that would normally be found adhering to the surface is burned off. This produces a clean area adjacent to areas darkened by products of combustion. (See Figure 4-11.) Clean burn is produced most commonly by direct flame contact or intense radiated heat.*

Although they can be indicative of intense heating in an area, clean burn areas by themselves do not necessarily indicate areas of origin. The lines of demarcation between the clean burn and sooted areas may be used by the investigator to determine direction of fire spread or differences in intensity or time of burning.

The investigator should be careful not to confuse the clean burn area with spalling. Clean burn does not show the loss of surface material that is a characteristic of spalling. (NFPA 921-01-4-11)

The above captioned burn pattern was observed.

[28] CALCINATION. *The term calcination is used by fire investigators to cover the numerous changes that occur in plaster or gypsum wall surfaces during a fire. Calcination of a true plaster wall involves driving the chemically bound water out of the gypsum.*

The gypsum wallboard most often used has a more complex response to heat than plaster. First the paper surface will char and might also burn off. The gypsum on the side exposed to fire becomes gray from charring of the organic binder and stiffener in it. With further heating, the gray color will go all the way through, and the paper surface on the backside will char. The face exposed to fire will become whiter as the carbon is burned away. When the entire thickness of wallboard has turned whitish, there will be no paper left on either face, and the gypsum will be dehydrated and converted to a crumbly solid. Such a wallboard might stay on a vertical wall but will drop off of an overhead surface. Fire-rated gypsum wallboard has mineral fibers or vermiculite particles embedded in the gypsum to preserve the strength of the wallboard during fire exposure. The fibers add strength to the wallboard even after it has been thoroughly calcined.

Color changes other than shades of gray may occur after gypsum wall surfaces are exposed to heat. The color itself has no significance to the fire investigator. However, the difference between colors may show lines of demarcation.

The relationship between the calcined and not calcined areas on plaster or gypsum wallboard can also display lines of demarcation. (NFPA 921-01-4-12)

The above captioned burn pattern was not observed.

[29] DEPTH OF CALCINATION. *Certain key variables affect the validity of depth of calcination analysis. These factors include the following: (a) Single versus multiple heat or fuel sources, creating the calcination patterns being measured, should be considered. Depth of calcination patterns may be useful in determining multiple heat or fire sources. (b) Comparisons of depth of calcination measurements should be made only from the same material. It should be recognized that gypsum wallboard comes in different thicknesses, uses different materials of construction, and does change with time. The investigator must carefully consider sections of walls or ceilings that may have had new sections inserted as a repair. (c) The finish of the gypsum wallboard (e.g., paint, wallpaper, stucco) should be considered when evaluating depth of calcination. The investigator should recognize that some of these finishes are combustible and may affect the patterns if they are ignited. (d) Measurements should be made in a consistent fashion to eliminate errors in this data collection, as discussed in 4.12.4 (e) Gypsum wallboard can be damaged during suppression, overhaul and post-fire by hose streams and standing water to the point where little or no reliable measurements can be made. (NFPA 921-01-4-12.3)*

The above captioned burn pattern was not observed.

[30] BREAKING OF GLASS. *If a pane of glass is mounted in a frame that protects the edges of the glass from radiated heat of fire, a temperature difference occurs between the unprotected portion of the glass and the protected edge. Experimental research estimates that a temperature difference of about 70°C (158°F) between the center of the pane of glass and the protected edge can cause cracks that start at the edge of the glass. The cracks appear as smooth, undulating lines that can spread and join together. Depending on the degree of cracking, the glass may or may not collapse from its frame.*

If a pane of glass has no edge protection from radiated heat of fire, the glass will break at a higher temperature difference. Also, experimental research suggests that fewer cracks are formed and the pane is more likely to stay whole.

Glass that has received an impact will have a characteristic "cobweb" pattern. The cracks will be in straight lines and numerous. The glass may have been broken before, after, or during the fire. If flame suddenly contacts one side of a glass pane while the unexposed side is relatively cool, a stress can develop between the two faces and the glass can fracture between the faces.

Crazing is a term used in the fire investigation community to describe a complicated pattern of short cracks in glass. These cracks may be straight or crescent-shaped and may or may not extend through the thickness of the glass. Crazing has been theorized as being the result of very rapid heating of one side of the glass while the other side remains cool. There is no published research to confirm this theory. However, there is published research establishing that crazing can be created by the rapid cooling of glass by the application of water spray in a hot environment.

Occasionally with small size panes, differential expansion between the exposed and unexposed faces may result in the pane popping out its frame. The pressures alone developed by fires in buildings generally are not sufficient to either break glass windows or force them from their frames. Pressures required to break ordinary window glass are in the order of 0.3 psi to 1.0 psi (2.07 kPa to 6.90 kPa) while pressures from fire are in the order of 0.002 psi to 0.004 psi (0.014 kPa to 0.028 kPa). If an overpressure has occurred — such as a deflagration, backdraft, or detonation — glass fragments from a window broken by the pressure will be found some distance from the window. For example, an overpressure of 1.5 psi (10.3 kPa) can cause fragments to travel as far as 100 ft (30.3 m).

The investigator is urged to be careful not to make conclusions from glass breaking morphology alone. Both crazing and long, smooth, undulating cracks have been found in adjacent panes. The small craters or pits found in the surface of glass are believed to be the result of rapid cooling by water spray during fire suppression activities. (NFPA 921-01-4-13.1)

The above captioned burn pattern was observed.

[31] TEMPERED GLASS. *Tempered glass, whether broken when heated by fire impact or when exploded, will break into many small cube-shaped pieces. Such glass fragments should not be confused with crazed glass. Tempered glass fragments are more regularly shaped than the complicated pattern of short cracks of crazing.*

Tempered glass is commonly found in applications where safety from breakage is a factor — such as in shower stalls, patio doors, TV screens, motor vehicles, and in commercial and other public buildings.
(NFPA 921-01-4-13.2)

The above captioned burn pattern was observed.

[32] STAINING OF GLASS. *Glass fragments that are free of soot or condensates have likely been subjected to rapid heating, failure early in the fire, or flame contact. The proximity of the glass to the area of origin or heat source and ventilation are factors that can affect the degree of staining.*

The presence of a thick, oily soot on glass, including hydrocarbon residues, has been interpreted as positive proof of the presence or use of liquid accelerant. Such staining can also result from the incomplete combustion of other fuels such as wood and plastics and cannot be exclusively interpreted as having come from an accelerant. (NFPA 921-01-4-13.3)

The above captioned burn pattern was observed.

[33] COLLAPSED FURNITURE SPRINGS. *The collapse of furniture springs may provide the investigator with various clues concerning the direction, duration, or intensity of the fire. However, the collapse of the springs cannot be used to indicate exposure to a specific type of heat source or ignition such as smoldering ignition or the presence of an ignitable liquid. The results of laboratory testing indicate that the annealed springs, and the associated loss of tension (tensile strength), is a function of the application of heat. These tests revealed that short-term heating at high temperatures and long-term heating at moderate temperatures over 750°F (400°C) can result in the loss of tensile strength and in the collapse of the springs. Tests also revealed that the presence of a load, or weight, on the springs while they are being heated increases the loss of tension.*

The value of analyzing the furniture springs is in comparing (comparative analysis) the differences in the springs to other areas of the mattress, cushion, frame, and so forth. Comparative analysis of the springs can assist the investigator in developing hypotheses concerning the relative exposure to a particular heat source. For example, if at one end of the cushion or mattress the springs have lost their tension and the other end has not, then hypotheses may be developed, while taking into consideration other circumstances, effects (such as ventilation), and evidences at the scene concerning duration or intensity of the fire, the area of origin or the direction of heat travel, or relative proximity of the heat source. In any event, the portion with the loss of spring strength may indicate greater relative exposure to heat than those areas without the loss of strength. Other circumstances and effects that may be considered along with analyzing the springs include the loss of mass and material or depth of char to the frame if constructed of wood. Similar analysis may also include color changes, possibly indicating intensity, in metal frames.

Still other effects for comparative analysis include considerations of the covering material of the springs. The absence of material may indicate that the portion closer to the source of heat, while the presence of materials may indicate an area more remote from the heat source. (NFPA 921-01-4-14)

The above captioned burn pattern was not observed.

[34] LOSS OF MASS. *Other circumstances and effects that may be considered along with analyzing the springs include the loss of mass and material or depth of char to the frame if constructed of wood. Similar analysis may also include color changes, possibly indicating intensity, in metal frames.*

Still other effects for comparative analysis include considerations of the covering material of the springs. The absence of material may indicate that the portion closer to the source of heat, while the presence of materials may indicate an area more remote from the heat source. (NFPA 921-01-4-14)

The above captioned burn pattern was not observed.

[35] COVERING MATERIAL. *Other circumstances and effects that may be considered along with analyzing the springs include the loss of mass and material or depth of char to the frame if constructed of wood. Similar analysis may also include color changes, possibly indicating intensity, in metal frames.*

Still other effects for comparative analysis include considerations of the covering material of the springs. The absence of material may indicate that the portion closer to the source of heat, while the presence of materials may indicate an area more remote from the heat source. (NFPA 921-01-4-14)

The above captioned burn pattern was not observed.

[36] HEAT SHADOWING. *Heat shadowing results from an object blocking the travel of radiated heat, convected heat, or direct flame contact from its source to the material on which the pattern is produced. Conducted heat, however, does not produce heat shadowing.*

The object blocking the travel of the heat energy may be a solid or liquid, combustible or noncombustible. Any object that absorbs or reflects the heat energy may cause the production of a pattern on the material it protects.

Heat shadowing can change, mask, or prohibit the production of identifiable lines of demarcation that may have appeared on that material. Patterns produced by the heat shadowing, may, however, assist the fire investigator in the process of reconstruction during origin determination. (NFPA 921-01-4-15.1)

The above captioned burn pattern was observed.

[37] PROTECTED AREA. *Closely related in appearance to the resulting pattern of heat shadowing is a protected area. A protected area results from an object preventing the products of combustion from depositing on the material that the object protects, or prevents the protected material from burning. The object preventing the depositing of products of combustion may be a solid or liquid, combustible or noncombustible. Any object that prevents the settling of the products of combustion, or prevents the burning of the material, may prevent the development of a pattern on the material it protects.*

Patterns produced by protected areas may, however, assist the fire investigator in the process of fire scene reconstruction during the origin determination by indicating the location of objects in their pre-fire locations. (NFPA 921-01-4-15.2)

The above captioned burn pattern was observed.

[38] CURLED TILE EDGES. *Floors should not be ignored by the investigator. Patterns on floors and floor coverings can be produced by the effects of intense radiation from flaming furniture, burning plastics, or liquids, or from the hot gas layer produced by flaming combustion. Should flashover occur, it results from a radiant heat flux that exceeds 20 kW/m², a typical value for the radiant ignition of common combustible construction materials. Post-flashover or full room involvement conditions can typically produce fluxes in excess of 170 kW/m² and may modify or obliterate pre-existing patterns.*

Flashover produces a radiant heat flux that exceeds 2 watts/cm², a typical value for the radiant ignition of common combustible construction materials.

Fire-damaged vinyl floor tiles often exhibit curled tile edges exposing the floor beneath. The curling of tile edges can frequently be seen in nonfire situations and is due to natural shrinkage and curling of the tiles from loss of plasticizer. In a fire situation, the presence of radiation from a hot gas layer will produce the same patterns. This pattern can also be caused by ignitable liquids. Analysis for their presence may be difficult due to the presence of hydrocarbons in tile adhesives. (NFPA 921-01-4-16.1.4)

The above captioned burn pattern was not observed.

[39] OUTSIDE. *External surfaces of structures can also display fire patterns. In addition to the regular patterns, both vertical and horizontal external surfaces can display burn-through. All other variables being equal, these burn-through areas can identify areas of intense or long-duration burning. (NFPA 921-01-16.2)*

The above captioned burn pattern was observed.

[40] LOW BURN. *It is common for the lowest portions of fire patterns to be closer to their heat sources. In general, fires tend to burn upward and outward from their origins. Fire plumes made up of the hot gases and airborne products of combustion are expanding and less dense than the surrounding air and are therefore buoyant.*

The growth in volume and buoyancy causes these heated products to rise and spread. The investigator should identify these areas of low burning and be cognizant of their possible proximity to a point of origin. (NFPA 921-01-4-16.4.1)

The above captioned burn pattern was not observed.

[41] DROP DOWN/FALL DOWN. *The investigator should keep in mind that during the progress of a fire, burning debris often falls to lower levels and then burns upward from there. This occurrence is known as "fall down" or "drop down." Fall down can ignite other combustible materials producing low burn patterns that may be confused with the area of fire origin. (NFPA 921-01-4-16.4.2)*

The above captioned burn pattern was observed.

[42] "V" PATTERN. *The appearance of the V-shaped pattern is created by flames, convective or radiated heat from hot fire gases, and smoke within the fire plume. (See 4-2.1.) The V pattern often appears as lines of demarcation (see 4-3.1) defining the borders of the fire plume and less heated areas outside the plume.*

The angle of the V-shaped pattern is dependent on several variables (see 4-2.1), including the following:

- (a) The heat release rate (HRR) and geometry of the fuel*
- (b) The effects of ventilation*
- (c) The ignitibility of the vertical surface on which it appears and combustibility of the vertical surface on which they appear*
- (d) The presence of interceding horizontal surfaces such as ceilings, shelves, table tops, or the overhanging construction on the exterior of a building*
(See 4-2.1.)

The angle of the borders of the V pattern does not indicate the speed of fire growth, such as a wide V indicating a slowly growing fire or a narrow V indicating a rapidly growing fire. (NFPA 921-01-4-17.1)

The above captioned burn pattern was observed.

[43] INVERTED CONE. *Inverted cones are commonly caused by the vertical flame plumes of the burning volatile fuels not reaching the ceiling.*

Inverted cone patterns are manifestations of relatively short-lived fires that do not fully evolve into floor-to-ceiling flame plumes or flame plumes that are not vertically restricted by ceilings. Because they often appear on noncombustible surfaces, they do not always readily spread to nearby combustibles. For this reason, many investigators have taken to inferring from these patterns that the fires that caused them were fast burning.

The correct analysis of such patterns is that the burning was of relatively short duration rather than any relationship to the rate of heat release. That short duration occurred because additional fuel sources did not become involved after the initial fuel was consumed.

Inverted cone patterns have been interpreted as proof of flammable liquid fires, but any fuel source (leaking fuel gas, Class A fuels, etc.) that produces flame zones that do not become vertically restricted by a horizontal surface, such as a ceiling or furniture, can produce inverted cone patterns. (NFPA 921-01-4-17.2; 4-17.2.1)

The above captioned burn pattern was not observed.

[44] INVERTED CONE/NATURAL GAS. *Leaking natural gas is prone to the production of inverted cone patterns. This is especially true in the case of natural gas if the leakage occurs from below floor level and escapes above at the intersection of the floor and a wall. The subsequent burning often does not reach the ceiling and is manifested in the production of the characteristic triangular inverted cone pattern shape. (NFPA 921-01-4-17.2.2)*

The above captioned burn pattern was not observed.

[45] HOURGLASS. *The plume of hot gases above a fire is composed of a hot gas zone shaped like a V and a flame zone at its base. The flame zone is shaped like an inverted V. When the hot gas zone is truncated by a vertical plane surface, the typical V pattern is formed. If the fire itself is very close to or in contact with the vertical surface, the resulting pattern will show the effects of both the hot gas zone and the flame zone together as a large V above an inverted V. The inverted V is generally smaller and may exhibit more intense burning or clean burn. The overall pattern that results is called an "hourglass." (NFPA 921-4-17.3)*

The above captioned burn pattern was not observed.

[46] U-SHAPED. *"U" patterns are similar to the more sharply angled V patterns but display gently curved lines of demarcation and curved rather than angled lower vertices. (See Figure 4-17.4.) U-shaped patterns are created by the effects of radiant heat energy on the vertical surfaces more distant from the same heat source than surfaces displaying sharp V patterns. The lowest lines of demarcation of the U patterns are generally higher than the lowest lines of demarcation of corresponding V patterns that are closer to the fire source. U patterns are analyzed similarly to V patterns, with the additional aspect of noting the relationship between the heights of the vertex of the U pattern as compared to the height of the vertex of the corresponding V patterns.*

If there are two patterns from the same heat source, the one with the lower vertex will be closer to that heat source. (NFPA 921-01-4-17.4)

The above captioned burn pattern was observed.

[47] TRUNCATED CONE. *Truncated cone patterns, also called truncated plumes, are three-dimensional fire patterns displayed on both horizontal and vertical surfaces. It is the interception or truncating of the natural cone-shaped or hourglass-shaped effects of the fire plume by these vertical and horizontal surfaces that causes the patterns to be displayed. Many fire movement patterns, such as V patterns, U patterns, circular patterns, and "pointer or arrow" patterns, are related directly to the three-dimensional "cone" effect of the heat energy created by a fire.*

The cone-shaped dispersion of heat is caused by the natural expansion of the fire plume as it rises and the horizontal spread of heat energy when the fire plume encounters an obstruction to its vertical movement, such as the ceiling of a room. Thermal damage to a ceiling will generally extend beyond the circular area attributed to a "truncated cone." The truncated cone pattern combines two-dimensional patterns such as V-shaped patterns, pointers and arrows, and U-shaped patterns on vertical surfaces with the circular patterns displayed on ceilings and other horizontal surfaces.

The combination of more than one two-dimensional pattern on perpendicular vertical and horizontal surfaces gives the truncated cone pattern its three-dimensional character.

A theoretical demonstration of the truncated cone pattern is when the four vertical walls of a room each display varied V or U patterns, as well as circular or portions of circular patterns appearing on the ceiling. Corresponding patterns may also be discernible on the furnishings in the room. (NFPA 921-01-4-17.5)

The above captioned burn pattern was not observed.

[48] POINTER AND ARROW. *These fire patterns are commonly displayed on a series of combustible elements such as wooden studs or furring strips of walls whose surface sheathing has been destroyed by fire or was nonexistent. The progress and direction of fire spread along a wall can often be identified and traced back toward its source by an examination of the relative heights and burned-away shapes of the wall studs left standing after a fire. In general, shorter and more severely charred studs will be closer to a source of fire than taller studs. The heights of the remaining studs increase as distance from a source of fire increases. The difference in height and severity of charring will be noted on the studs.*

The shape of the studs' cross section will tend to produce "arrows" pointing back toward the general area of the source of heat. This is caused by the burning off of the sharp angles of the edges of the studs on the sides toward the heat source that produces them. More severe charring can be expected on the side of the stud closest to the heat source. (NFPA 921-01.17.6)

The above captioned burn pattern was not observed.

[49] CIRCULAR-SHAPED. *Patterns that are generally circular in shape are common at fire scenes. These patterns are never truly circular unless they represent areas that have been protected from burning by circular items, such as wastebaskets or the bottoms of furniture items.*

Patterns on the underside of horizontal surfaces — such as ceilings, tabletops, and shelves — can appear in roughly circular shapes. The more centralized the heat source, the more circular or nearly circular the patterns may appear.

Portions of circular patterns can appear on the underside of surfaces that partially block the heated gases or fire plumes. This can occur when the edge of the surface receiving the pattern does not extend far enough to show the entire circular pattern or when the edge of the surface is adjacent to a wall.

Within the circular pattern, the center may show more heat treatment, such as deeper charring. By locating the center of the circular pattern, the investigator may find a valuable clue to the source of greatest heating, immediately below. (NFPA 921-01.4-17.7)

The above captioned burn pattern was not observed.

[50] IRREGULAR. *Irregular, curved, or "pool-shaped" patterns on floors and floor coverings cannot always be reliably identified as resulting from ignitable liquids on the basis of observation alone. The lines of demarcation between the damaged and undamaged areas of irregular patterns range from sharp edges to smooth graduations depending on the properties of the material and the intensity of heat exposure. Denser materials like oak flooring will generally show sharper lines of demarcation than thermoplastic (e.g., nylon) carpet. The absence of a carpet pad often leads to sharper lines.*

These patterns are common in situations of post-flashover conditions, long extinguishing times, or building collapse. These patterns may result from the effects of hot gases, flaming and smoldering debris, melted plastics, or ignitable liquids. If the presence of ignitable liquids is suspected, supporting evidence such as the use of a combustible gas indicator, chemical analysis of debris for residues, or the presence of liquid containers should be sought. It should be noted that many plastic materials release hydrocarbon fumes when they pyrolyze or burn. These fumes may have an odor similar to that of petroleum products and can be detected by combustible gas indicators when no ignitable liquid accelerant has been used. A "positive" reading should prompt further investigation and the collection of samples for more detailed chemical analysis.

It should be noted that pyrolysis products, including hydrocarbons, can be detected in gas chromatographic analysis of fire debris in the absence of the use of accelerants. It can be helpful when analyzing carpet debris for the laboratory to burn a portion of the comparison sample and run a gas chromatographic analysis on both. By comparing the results of the burned and unburned comparison samples with those from the fire debris sample, it may be possible to determine whether or not hydrocarbon residues in the debris sample were products of pyrolysis or residue of an accelerant.

However, when overall fire damage is limited and small or isolated, irregular patterns are found, the presence of ignitable liquids may be more likely, although the use of supporting evidence is still recommended.

Pooled ignitable liquids that soak into flooring or floor covering materials as well as melted plastic can produce irregular patterns. These patterns can also be produced by localized heating or fallen fire debris. (NFPA 921-01-17.7.2)

The above captioned burn pattern was not observed.

[51] DOUGHNUT-SHAPED. *A distinct doughnut-shaped pattern where a roughly ring-shaped burn area surrounds a less burned area may result from an ignitable liquid. When a liquid causes this pattern, it is due to the effects of the liquid cooling the center of the pool as it burns while flames at the perimeter of the doughnut produce charring of the floor or floor covering. When this condition is found, further examination should be conducted as supporting evidence to the presence of ignitable liquids. (NFPA 921-01-4-17.7.3)*

The above captioned burn pattern was not observed.

[52] LIQUIDS VERSUS MELTED SOLIDS. *Many modern plastic materials will burn. They react to heating by first liquefying, and, then, when they burn as liquids, they produce irregularly shaped or circular patterns. When found in unexpected places, such patterns can be erroneously identified as flammable or combustible liquid patterns and associated with an incendiary fire cause.*

Often the association of an ignitable liquid with a particular irregular pattern has been ruled out on the presumption that ignitable liquid vapors will always cause explosions. This is not the case. The expansion of the products of combustion from flammable liquids will cause explosions only if they are sufficiently confined to damage the structure or confining vessel and have the proper fuel/air mixture. Whether an explosion occurs is a function of the quantity of vaporized fuel present at the time of ignition, the presence of venting openings in the structure, and the strength and construction of the confining structure.

The investigator should be careful to properly identify the initial fuel source for any irregularly shaped or circular patterns. (NFPA 921-01-4-17.8)

The above captioned burn pattern was observed.

[53] COMMERCIAL FUEL GAS. *The burning of the common commercial fuel gases, natural gas and liquefied petroleum (LP) gases, can provide distinctive fire patterns. Distinctive localized burning between ceiling joists, between interior vertical wall studs, and in the corners of ceilings of rooms is quite common and a good indicator of the presence of natural gas.*

Natural gas has a vapor density of 0.65; therefore, it is lighter than air and will rise when released. This property of natural gas will create gas pockets in the upper areas of rooms and structures.

The liquefied petroleum (LP) gases, being heavier than air (with vapor densities of about 1.5 for propane and 2.0 for butane), also tend to pocket within a structure, though at low levels. However, the buoyant nature of their products of combustion when ignited prevents them from producing similar pocketing burn patterns as natural gas. (NFPA 921-01-4-17.9)

The above captioned burn pattern was not observed.

[54] SADDLE BURN. *"Saddle burns" are distinctive U- or saddle-shaped patterns that are sometimes found on the top edges of floor joists. They are caused by fire burning downward through the floor above the effected joist. Saddle burns display deep charring, and the fire patterns are highly localized and gently curved. (NFPA 921-01-4-17.10)*

The above captioned burn pattern was not observed.

[55] TRAILERS. *In many incendiary fires, when fuels are intentionally distributed or "trailed" from one area to another, the elongated patterns may be visible. Such fire patterns, known as "trailers," can be found along floors to connect separate fire sets, or up stairways to move fires from one floor or level within a structure to another. Fuels used for trailers may be ignitable liquids, solids, or combinations of these.*

After incendiary fires, when fuels have been intentionally distributed or "trailed" from one area to another, elongated patterns may be visible. Such fire patterns, known as "trailers," can be found along floors to connect separate fire sets, or up stairways to move fires from one story or level within a structure to another. Fuels used for trailers may be ignitable liquids, solids, or combinations of these. Materials such as clothing, paper, straw, and ignitable liquids are often used. Remnants of solid materials frequently are left behind and should be collected and documented.

Ignitable liquids may leave linear patterns, particularly when the fires are extinguished early. Radiant energy from the extension of flame or hot gases through corridors or up stairways can also produce linear patterns. As with suspected solid accelerants, samples of possible liquid accelerants should be collected and analyzed.

Often, when the floor area is cleared of debris to examine damage, long, wide, straight patterns will be found showing areas of extensive heat damage, bound on each side by undamaged or less damaged areas.

These patterns have often been interpreted to be trailers. While this is possible, the presence of furniture, stock, counters, or storage may result in these linear patterns. These patterns may also result from fire impact on worn areas of floors and the floor coverings. Irregularly shaped objects on the floor, such as clothing or bedding, may provide protection to the floor, resulting in patterns that may be inaccurately interpreted.

For example, gasoline itself poured out to assist the fire is an accelerant. It is the deliberate use of the gasoline to spread the fire from one location to another that causes the stream of gasoline to be a trailer. Trailing gasoline from one room to another and up the staircase constitutes laying a trailer. Dousing a building with gasoline from cellar to rooftop or over a widespread area does not constitute laying a trailer; instead, it is considered using an accelerant. So it can be seen that the fuel does not constitute a trailer, but rather the manner in which the fuel or accelerant is used. This is similar to the "use" requirement in the definition of an accelerant. The burning action has no effect on whether there is a trailer. Gasoline, rags, or newspapers can all be used as trailers, but they burn differently. The pattern that is left by a trailer is evidence of the trailer; the pattern is not the trailer. If an arsonist lays a trailer but is arrested prior to ignition, there is still a trailer. (NFPA 921-01-4-18.1 and 17.2.2)

The above captioned burn pattern was not observed.

[56] PROTECTED FLOOR AREAS. *Often when the floor area is cleared of debris to examine damage, long, wide, straight patterns will be found showing areas of extensive heat damage bounded on each side by undamaged or less damaged areas. These patterns often have been interpreted to be "trailers." While this is possible, the presence of furniture, stock, counters, or storage may result in these linear patterns. These patterns may also result from wear on floors and the floor covering due to high traffic. Irregularly shaped objects on the floor, such as clothing or bedding, may also provide protection and produce patterns that may be inaccurately interpreted. (NFPA 921-01-4-18.2)*

The above captioned burn pattern was observed.

[57] FUEL GAS JETS. *Jets of ignited fuel gases, such as LP or natural gas, can produce linear patterns or lines of demarcation, particularly on noncombustible surfaces. (NFPA 921-01-4-18.3)*

The above captioned burn pattern was not observed.

[58] AREA PATTERNS. *Some patterns may appear to cover entire rooms or large areas without any readily identifiable sources or beginnings. These patterns are most often formed when the fuels that create them are widely dispersed before ignition, or when the movement of the fire through the areas is very rapid as in a flash fire. (NFPA 921-01-4-19)*

The above captioned burn pattern was not observed.

[59] FLASHOVER & FULL ROOM INVOLVEMENT. *In the course of a flashover transition, fire spreads rapidly to all exposed combustible materials as the fire progresses to full room involvement. This process can produce relatively even burning on vertical surfaces. If the fire is terminated before full room involvement, relatively uniform burning can be evident above the bottom of the hot layer. When the fire has progressed to full room involvement, the area pattern may be uneven and extend to the base of the wall. (NFPA 921-01-4-19.2)*

The above captioned burn pattern was not observed.

[60] FLASH FIRES. *The ignition of gases or the vapors of liquids does not necessarily always cause explosions. Whether or not an explosion occurs depends on the location and concentration of diffuse fuels and on the geometry, venting, and strength of the confining structure.*

If the diffuse fuels are near the lower flammable or explosive limit (LEL) and there is no explosion, the fuels may burn as a flash fire, and there may be little or no subsequent burning. In the instance where the first fuel to be ignited is a diffuse fuel/air mixture, the area of greatest destruction may not, and generally does not, coincide with the area where the heat source ignites the mixture. The greatest destruction will occur where the flash fire from the burning mixture encounters a secondary fuel load that is capable of being ignited by the momentary intense temperature in the flame front. Likewise, once secondary ignition occurs, the dynamics of the fire spread will be dictated by the compartment and fuel geometry and the relative heat release rates of these secondary fuels. The relatively short duration of the burning mixture may have little impact on the flashover in the compartment as compared to the burning of the secondary fuels.

Therefore, origin determination of such a flash fire is dependent on accurate witness observations and the analysis of the potential ignition sources in the areas where the vapor or gas could have existed.

Without accurate witness statements and careful analysis of potential ignition sources, the investigator is left with the analysis of fire patterns as the only means of determining the origin. The difficulty of this task is that the resultant ignition of the secondary fuels and compartment flashover can camouflage the subtle patterns created by the flash fire.

This is caused by the total consumption of the available fuel without significantly raising the temperatures of other combustibles. In this case, the fire patterns may be superficial and difficult to trace to any specific point of ignition. In addition, separate areas of burning from pocket fuel gas may exist and further confuse the tracing of fire spread. (NFPA 921-01-4-19.2)

The above captioned burn pattern was not observed.

[61] MATERIAL DISTORTION. *Fire patterns are the visible or measurable physical effects that remain after a fire. These include thermal effects on materials, such as charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse, and other effect. Patterns can be seen in the physical change of shape and distortion of some objects that are subjected to the heat of the fire. (NFPA 921-01-4-3; NFPA 921-01-4-20)*

The above captioned burn pattern was observed.

[62] DISTORTED "PULLED" LIGHT BULBS. *Incandescent light bulbs can sometimes show the direction of heat impingement. As the side of the bulb facing the source of heating is heated and softened the gases inside a bulb of greater than 25 watts can begin to expand and bubble out the softened glass. This has been traditionally called a "pulled" light bulb, though the action is really a response to internal pressure rather than a pulling. The bulged or pulled portion of the bulb will be in the direction of the source of the heating. Because they contain a vacuum, bulbs of 25 watts or less can be pulled inward on the side in the direction of the source of heating.*

Often these light bulbs will survive fire extinguishment efforts and can be used by the investigator to show the direction of fire travel. In evaluating a distorted light bulb, the investigator should be careful to ascertain that the bulb has not been turned in its socket by prior investigators or fire service personnel. (NFPA 921-01-4-20.1)

The above captioned burn pattern was not observed.

[63] METAL CONSTRUCTION ELEMENTS. *Studs, beams, columns, and the construction components that are made of high-melting-point metals, such as steel, can be distorted by heating. The higher the coefficient of thermal expansion of the metal, the more prone it is to heat distortion. The amount and location of distortion in a particular metal construction can indicate which areas were heated to higher temperatures or for longer times. In some cases, elongation of beams can result in damage to walls. (NFPA 921-01-4-20-2)*

The above captioned burn pattern was observed.

[64] TIDEMARKS. *Whether lighter- or heavier-than-air gases are involved, there may be evidence of the passage of flame where the fuel air layer was. Scorching, blistering of paintwork, and showing of "tidemarks" are indicators of this type of phenomena. (NFPA 921-01-13-8.2.2)*

The above captioned burn pattern was not observed.

[65] BEADS ON CONDUCTORS. *The conductors downstream from the power source and the point where the conductors are severed become de-energized. Those conductors will likely remain in the debris with part or all of their insulation destroyed. The upstream remains of the conductors between the point of arc-severing and the power supply may remain energized if the overcurrent protection does not function. Those conductors can sustain further arcing through the char. In a situation with multiple arc-severing on the same circuit, arc-severing farthest from the power supply occurred first. It is necessary to find as much of the conductors as possible to determine the location of the first arcing through char. This will indicate the first point on the circuit to be compromised by the fire and may be useful in determining the area of origin. In branch circuits, holes extending for several inches may be seen in the conduit or in metal panels to which the conductor arced.*

If the fault occurs in service entrance conductors, several feet of conductor may be partly melted or destroyed by repeated arcing because there is usually no overcurrent protection for the service entrance. An elongated hole or series of holes extending several feet may be seen in the conduit. (NFPA 921-01-14-10.3)

The above captioned burn pattern was not observed.

[66] MULTIPLE FIRES. *Multiple fires are two or more separate, nonrelated, simultaneously burning fires. The investigator should search to uncover any additional fire sets or points of origin that may exist. In order to conclude that there are multiple fires, the investigator should determine that any "separate" fire was not the natural outgrowth of the initial fire.*

Fires in different rooms, fires on different stories with no connecting fire, or separate fires inside and outside a building are examples of multiple fires. A search of the fire building and its surrounding areas should be conducted to determine whether there are multiple fires.

Apparent multiple fires can result through spread by the following means:

- (a) Conduction, convection, or radiation*
- (b) Flying brands*
- (c) Direct flame impingement*
- (d) Falling flaming materials (i.e., drop down) such as curtains*
- (e) Fire spread through shafts, such as pipe chases or air conditioning ducts*
- (f) Fire spread within wall or floor cavities within "balloon construction"*
- (g) Overloaded electrical wiring*
- (h) Utility system failures*

Apparent multiple points of origin can also result from continued burning at remote parts of a building during fire suppression and overhaul, particularly when building collapse or partial building collapse is involved.

The earlier a fire is extinguished, the easier it is to identify multiple points of origin. Once full room involvement or room-to-room extension has occurred, identifying multiple fires becomes more difficult and a complete burnout or "black hole" may make identification impossible.

If there has been a previous fire in the building, care should be taken not to confuse earlier damage with a multiple fire situation.

Fire scene reconstruction an important aspect of the fire scene examination, is especially important when multiple fires are suspected.

A careful examination of the fire scene may reveal additional fire sets (which are intended to ignite additional fires), particularly in the same type of area. For example, if the investigator observes or discovers an area of origin in a closet, an examination of other closets for additional fires or fire sets is prudent. The investigator may be required to obtain legal authority to conduct a search in areas not affected or involved in the discovered fire.

Confirmation of multiple fires is a compelling indication that the fire was incendiary. (NFPA 921-01-17-2.1)

The above captioned burn pattern was not observed.

[67] PATTERN PERSISTENCE THROUGH FLASHOVER.

Flashover is a transition phase in the development of a contained fire in which surfaces exposed to thermal radiation reach ignition temperature more or less simultaneously and fire spreads rapidly throughout the space. Generally, the origin of the fire has been subjected to the longest burn time. After flashover the origin of fire will usually reveal the most significant burn pattern.

This simultaneous radiation of a flashover causes an even burn within the compartment. The original burn area or origin of the fire will usually be identified by more significant heat and flame damage. An infrared video camera sees images of contrast, same color with a darker area with the color. Pattern persistence through flashover is much like the infrared video camera. (Report on Full Scale Room Burn Pattern Study. United States Fire Administration Program for the Study of Fire Patterns. National Institute of Justice, 12/16/97) (National Institute of Standards and Technology) (San Marcos Full-Scale Burn Pattern Validation Tests I and II. Douglas Holmes, et al and The Central Texas Fire Investigators' Association. May 3-6, 2000; September 25-29, 2000).

The above captioned burn pattern was not observed.

[68] SPRING SAG. *Spring sag or the relaxation of springs may be used to identify movement fire patterns. Their value may be found in the comparison of spring relaxation or annealing. Application of weight to the springs, e.g., ceiling fan falling onto the bed, must be eliminated. Caution should be used when attempting to utilize spring sag for intensity values of the fire. (Full Scale Room Burn Pattern Study. Anthony D. Putorti, Jr. Fire Safety Engineering Division, Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, 20899-0001, December, 1997). (U. S. Department of Justice, Office of Justice Programs, National Institute of Justice, Law Enforcement and Corrections Standards and Testing Program, NIJ Report 601.97). (San Marcos Full-Scale Burn Pattern Validation Tests I and II. Douglas Holmes, et al and The Central Texas Fire Investigators' Association. May 3-6, 2000; September 25-29, 2000).*

The above captioned burn pattern was not observed.

[69] DOORWAY CHAR INDICATOR. *The value of careful analysis of door char indicators will assist the fire investigator in the establishment of door positions. The position of doors is often important in the careful consideration of fire movement and ventilation dynamics. (Full-Scale Room Burn Pattern Study. Anthony D. Putorti, Jr. Fire Safety Engineering Division, Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, 20899-0001, December, 1997). (U. S. Department of Justice, Office of Justice Programs, National Institute of Justice, Law Enforcement and Corrections Standards and Testing Program, NIJ Report 601.97). (San Marcos Full-Scale Burn Pattern Validation Tests I and II. Douglas Holmes, et al and The Central Texas Fire Investigators' Association. May 3-6, 2000; September 25-29, 2000).*

The above captioned burn pattern was observed.

[70] NEUTRAL PRESSURE PLANE. *If buoyancy forces are the only ones acting on the gases, then the pressure will be above atmospheric near the top of the compartment and below atmospheric near the bottom. There will be a neutral pressure plane where the pressure is the same inside as outside the compartment. (J. H. McGuire, Smoke Movement In Buildings, Fire Technology 3,3,163-167, 1967.) (The SFPE Handbook of Fire Protection Engineering, NFPA, First Edition, Smoke and Heat Venting, P. L. Hinkley). (San Marcos Full-Scale Burn Pattern Validation Tests I and II. Douglas Holmes, et al and The Central Texas Fire Investigators' Association. May 3-6, 2000; September 25-29, 2000).*

The above captioned burn pattern was observed.

[71] THERMAL INTERFACE. *Thermal interface is often referred to as "smoke lines" by experienced fire investigators. These patterns are found on vertical surfaces, usually the walls of a compartment. The height of the thermal interface from the floor may assist the fire investigator in finding the fire origin. The thermal interface fingerprint is both a movement and intensity pattern. The identification of the movement of the fire is the most significant value of this pattern. Descending buoyant layer of products of combustion form the thermal interface or smoke line on the wall. The thermal interface is usually lowest and most intense in the compartment or room of origin.*

(Personal Communication with Dr. Vytenis Babrauskas, FPE) (San Marcos Full-Scale Burn Pattern Validation Tests I and II. Douglas Holmes, et al and The Central Texas Fire Investigators' Association. May 3-6, 2000; September 25-29, 2000).

The above captioned burn pattern was observed.

[72] SPLATTER. *Splatter patterns are usually observed when ignitable liquids are vigorously poured or "splattered". Splatter patterns can be found under conditions of accidental spills of ignitable liquids. The analysis of splatter patterns follows the physical laws of "blood splattering" and other fluid splatters. Criminal investigators often use blood splatter patterns when investigating homicides. Blood Splattering experts are most often utilized in homicide investigations.*

(Personal Communication with Jerry Welch, Houston Police Department, Homicide Department, "Blood Splattering Expert"). (*San Marcos Full-Scale Burn Pattern Validation Tests I and II*. Douglas Holmes, et al and The Central Texas Fire Investigators' Association. May 3-6, 2000; September 25-29, 2000).

The above captioned burn pattern was not observed.

[73] BLISTERS ON VINYL FLOOR. *Flammable liquid can be suspected if asphalt floor tiles have an irregular burn pattern and are discolored, perhaps blistered. The comparative analysis of the blistering of vinyl floor may yield movement and intensity patterns. (IFSTA - Fire Cause Determination, IFSTA, First Edition, Figure 6.21, p. 83).*

The above captioned burn pattern was not observed.

[74] INCANDESCENT LIGHT BULB FILAMENTS. The examination of the filament can document the status of the light bulb when the glass envelope was violated. Was the light on or off? Fire pattern damage indicators of the filament include oxidation, fracture, or vaporization of the filament of an energized light. The lack of these patterns documents that the light bulb was non-energized light bulb at the time of glass envelope violation.

Energized incandescent light bulb filaments rated at fifty [50] watts or less will vaporize when exposed to the atmosphere. The diameter or thickness of the filament decreases with a reduction of the rated watts. Generally, the smaller the wattage of the lamp, the smaller the filament size.

The smaller the filament, the more significant the damage when the glass envelope is violated. Examination of the filament will assist the fire investigator in determining whether the light bulb was energized at the time of the violation of the glass envelope the incandescent light bulb.

Filaments of light bulbs from 60 to 100 watts will reveal significant oxidation and probable separation if the light bulb is energized at the time the glass envelope was violated. The larger filaments, 60-watts, 75-watts, and 100-watts, will probably not vaporize when exposed to the atmosphere. A notable exception would be the larger diameter filament found in light bulbs manufactured for "rough service".

Filaments are not designed to withstand the high-temperature oxidation that occurs in air, and a naked filament exposed to air will conduct electricity only for a short time before burning out. Its temperature, however, will be vastly greater than the surface temperature of the glass that is found in normal operation.

(Ignition: Principles and Applications to Fire Protection and Fire Investigation. Draft Manuscript. 091899, Vytenis Babrauskas, PhD., Fire Sciences and Technology, Inc. 9000 300th Place SE, Issaquah, WA, 01027, p. 389-390). (Full-Scale Explosion-Proof Compartment and Lamp Fixture Tests of 300-Watt Quartz Light Lamps, Doug and Bryan Holmes, June 1994, League City, Texas). (Incandescent Light Bulb Tests - 40 to 100-watts, Austin, Texas, Doug Holmes, Holly Hera, Terry Dees, Teri Kuehl, Tonya Hilton, and Cory Martin, December 27, 2000).

The above captioned burn pattern was not observed.

Work Cited for Burn Pattern Analysis

WORK CITED...

NFPA # 921-Guide to the Investigation of Fires and Explosions. National Fire Protection Association, National Fire Codes. 2001 Edition.

Kirk's Fire Investigation. DeHaan, John D., Ph.D, Brady, Prentice-Hall, Upper Saddle River, New Jersey, 07458, 4th Edition, 1997.

Full-Scale Room Burn Pattern Study. Anthony Putorti, Jr. Fire Safety Engineering Division, Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, 20899-0001. U. S. Department of Justice, Office of Justice Programs, National Institute of Justice, Law Enforcement and Corrections Standards and Testing Program, NIST Report 601.97. 12/97.

Program for the Study of Fire Patterns. National Institute of Standards and Technology, United States Fire Administration, and Federal Emergency Management Agency. July 16, 1997, FA 178.

San Marcos Burn Pattern Validation Tests 2000 - I. Douglas Holmes, Lloyd Young, PE, Robert Calderon, Bryan Holmes, Terry Dees, Cory Martin, P. R. Holmes, Brian Mansfield, Darold Bittick, Fire Marshal Ken Bell and the firefighters of the San Marcos Fire Department. Sponsor: The Central Texas Fire Investigators' Association. May 3-6, 2000.

San Marcos Burn Pattern Validation Tests 2000 - II. Doug Holmes, Bryan D. Holmes, Terry Dees, Teri Kuehl, Cory Martin, Holly Hera, Tonya Hilton, Jay Evans, Dave Raltar, PE, Paul Carper, PE, Salvador "Sammy" Russo and Ken Bell. Sponsor: The Central Texas Fire Investigators' Association. September 25-29, 2000.

Ignition: Principles and Applications to Fire Protection and Fire Investigation. Draft Manuscript. 091899, Vytenis Babrauskas, PhD., Fire Sciences and Technology, Inc. 9000 300th Place SE, Issaquah, WA, 98027.

Determination of Fire Patterns and Traces Due to Liquid Accelerants on Floor Coverings. SINTEF NBL, The Criminal Investigation Department (KRIPOS), and Trondheim Police Department. Trondheim, Norway. 2001.

Public Agency Training Council Full-Scale Burn Pattern Tests. Steve Riggs, Ray Powell, Terry Deas, Cory Martin, Shawn Keesler, Bryan Holmes, Teri Kuehl, J. J. Jack, Beau Montigue, Dustin Deutsch, and Doug Holmes. League City, Texas. April, 2002.

OBSERVATIONS

The observations reported by persons who witnessed the fire or were aware of conditions present at the time of the fire are enclosed within this report.

ERG-825-A 19784

CHEMISTRY/PHYSICS

Analysis of the chemistry and physics of the fire initiation, development, and growth as an instrument to related known or hypothesized fire conditions capable of producing those conditions.
[2001 NFPA #921]

A fire canine team and sampling was not used due to indigenious ignitable liquids present in the garage.

METHODOLOGY

The compilation and analysis of the factual data evaluated in this fire loss has been based on the Scientific Method as prescribed in *The National Fire Protection Association (NFPA) National Fire Codes - NFPA #921 - Guide for Fire and Explosion Investigation*. The professional level of performance required for fire investigators has been adhered to as per *NFPA #1033 - Standard for Professional Qualifications for Fire Investigator*. Additional literature referenced for methodology includes publications of the American Society of Testing Materials, National Fire Protection Association, Curriculums of the National Fire Academy, and Texas Commission on Fire Protection.

This investigation by Introspect is based upon a systematic approach recognized by the relevant scientific fire community. Introspect's methodology and technique has been subjected to peer review.

Fire scene reconstruction has been performed. [NFPA Handbook] Testing to support methodology and technique utilized has been established by the literature of the NFPA. The goal of the {NFPA 921} Committee is to "provide guidance to investigators that is based on accepted scientific principles or scientific research". The material within NFPA 921 and NFPA 1033 is prepared for general use and not directed to any particular judicial action pending. This literature is objective and based on scientific principals, technology, and methodology.

The formation of the above captioned conclusions are based upon the existence, maintenance and utilization of relevant NFPA and ASTM codes, standards, guidelines, or recommended practices when possible. This literature has widespread acceptance in the scientific community.

The hypotheses presented have withstood all appropriate challenges while all reasonable alternatives to the hypotheses have been considered and eliminated due to their failure to withstand a valid challenge.

The level of confidence for this evaluation is "Conclusive".

OWNER - OCCUPANT #01

Name: [REDACTED]
Address: [REDACTED]
City: Houston, Texas
Phone: Cellular: [REDACTED]

TDL: [REDACTED]
SSN: [REDACTED]
DOB: [REDACTED]

Owner/Occupant #01, after giving consent for the investigation and sample removal, related the following information to Fire Evaluator Doug Holmes:

- I have lived in this house since June of 1985.
- I have been married to Peggy since August 07, 1975.
- I bought the 1994 Lincoln Towncar in September of 1994. I bought it in Texas City, Texas.
- Temple-Lincoln Mercury has performed the work on the vehicle.
- I have not had any major repairs.
- I had to replace the load levers (bags) on the rear of the Lincoln.
- I have not received a recall noticed on the Lincoln Towncar.
- After the fire a public adjuster told me about some type of recall. Before this I had no information.
- I have not had previous house fires or car fires.
- It was a program car from Bob Higgins.
- I'm currently overseeing Barnett Chapel COGIC in Port Arthur.

- o My wife works for [REDACTED] She is an interpreter for Deaf and Hearing Impaired Students.
- o We were at 2524 Delano at the Williams Temple COGIC. My wife was speaking.
- o The Lincoln had been last driven on Friday afternoon.
- o The car had been in the garage for four or five hours before the fire.
- o The two single garage doors were open.
- o The garage was locked. The fire department had to force their way into the garage.
- o The Lincoln was the only car parked in the garage at the time of the fire.

OWNER/OCCUPANT #02:

Name: [REDACTED]
Address: [REDACTED]
City: Houston, Texas [REDACTED]
Phone: [REDACTED]
SSN: [REDACTED]
DOB: [REDACTED]

Owner/Occupant #02 related the following information to Fire Evaluator Doug Holmes:

- 01] I was not home at the time of the fire.**
- 02] My neighbors [REDACTED] told me about the fire.**
- 03] My husband sees to the maintenance of our vehicles.**

REPORTEE

[REDACTED]
Houston, Texas

Douglas Holmes interviewed [REDACTED] who advised the following:

- o I heard a loud noise and I ran out to see what was going on.
- o I just saw smoke.
- o My neighbor came out and asked what was going on.
- o I ran home and dialed 911.
- o The smoke was coming from the garage area.

[REDACTED]
Houston, Texas

Douglas Holmes interviewed [REDACTED] who advised the following:

- o I heard a loud noise.
- o I saw smoke while standing in my front yard.
- o I asked the neighbor, [REDACTED], to call the fire department.
- o The garage was smoking.
- o A few minutes later the smoke increased and I could see the flames coming from the rear.
- o The fire department showed up promptly.
- o They went to the rear and they opened up the rear.

FIRE OFFICIALS

**Houston Fire Department
Fire Station #67
Office: 281/777-1085; 281/777-1060
1620 W. Little York
Houston, Texas 77088**

COMMENTS:

- > Property owners not at home.**
- > Fire Originated in garage area**
- > Possibly on the hood of the vehicle.**
- > L-67 on scene.**
- > Made forcible entry with fire extinguisher.**
- > Without spread to home area.**
- > Ceiling was pulled in home area because of heavy smoke extending to house.**
- > Checked for possible extension.**
- > Arson #737 called to scene due to undetermined cause of fire.**

The fire report is enclosed.

EO02-020-A 18771

JURISDICTIONAL AUTHORITIES

A copy of their report has been requested and will be supplemented upon production.

ER02-020-A 19772

DISPOSITION

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Lloyd D. Young, P.E., BSSE, CPFI, CFI
Professional Engineer/Fire Investigator


Douglas Lee Holmes, AA, AA, BS, MPA, CPFI, CPFI
Master Fire Investigator/Inspector/Firefighter

INTROSPECT
Texas License # C-4800

1992-025-R 19773

HOUSTON FIRE DEPARTMENT
FIRE INCIDENT REPORT

DISTRICT 096 STAY 004 9
ADMINISTRATIVE PHIL
DISTRICT CHIEF - 76405

1002-020-0 10774

LINK

A- INCIDENT NUMBER: 20021597 SUPP: 0 INCIDENT DATE: 06/21/2002 INCIDENT TIME: 20:34
B- NUMBER OF PERSONNEL: 20 MUTUAL AID: NONE ARSON NUMBER 737/754 FIRE PREV
C- ADDRESS: [REDACTED] APT/SUITE: CENSUS TRAC: 52502
D- TYPE OF SITUATION FOUND (11): STRUCTURE FIRE TYPE OF ACTION TAKEN (1): EXTINGUISHMENT
E- FIXED PROPERTY USE (411): 1-FAMILY DWELL/TEAR ROOM IGNITION FACTOR (21): SUSP, W/DURING CIVIL DIST
F- OCCUPANTS NAME: [REDACTED] TELEPHONE: () -
G- OWNERS NAME: [REDACTED] TELEPHONE: () -
H- OWNERS ADDRESS: [REDACTED] HOUSTON TX [REDACTED]
I- COMPLEX (41): DWELLING COMPLEX(1-2 FAR) MOBILE PROPERTY TYPE ():
J- AREA OF FIRE ORIGIN (00): AREA ORIGIN UNDETERMINED EQUIPMENT INVOLVED (00): EQUIP, INVOLVED UNDETERMINED
K- FORM OF HEAT OF IGNITION (00): FORM OF HEAT UNDETERMINED TYPE OF MATERIAL (00): TYPE OF MATERIAL UNDETERMINED
L- FORM OF MATERIAL (00): FORM OF MAT, UNDETERMINED METHOD OF EXTINGUISHMENT (6): PRECONNECTED HOSE LINE
M- LEVEL OF FIRE ORIGIN (1): GRADE LEVEL TO 9 FT ABOVE ESTIMATED DOLLAR LOSS: \$10,000
N- NUMBER OF STORIES (1): 1 STORY CONSTRUCTION TYPE (6): PROTECTED ORDINARY
O- EXTENT OF FLAME DAMAGE (6): CONFINED TO ORIGIN EXTENT OF SMOKE DAMAGE (6): CONFINED TO STRUCT ORIGIN
P- DETECTOR PERFORMANCE (4): DETECTOR W/IN ROOM W/NOSE SPRINKLER PERFORMANCE (8): NO EQUIP PRESENT IN ROOM
Q- MATERIAL GENERATING SMOKE (63): SAWD WOOD AVERAGE OF SMOKE TRAVEL (9): AVERAGE OF TRAVEL W/CLASS
R- FORM MATERIAL WHEN MOST SMOKE (17): STRUCTURAL MEMBER, FRAMING
S- MOBILE PROPERTY TR: MAKE: MODEL: LIC: SER#
T- EQUIP INVOLVED TR: MAKE: MODEL: SER#
IRIT ESTABLISHED 7 PAYROLLS UNIT

COMMENTS:

PROPERTY OWNERS NOT AT HOME AND FIRE ORIGINATED IN GARAGE AREA AND POSSIBLY ON THE WOOD OF VEHICLE. L-87 ON SCENE AND MADE FORCEFUL ENTRY WITH FIRE EXTINGUISHER WITHOUT SPREAD TO HOME AREA. CEILING WAS PULLED IN HOME AREA BECAUSE OF HEAVY SMOKE EXTENDING TO HOME AREA AND CHECKED FOR POSSIBLE EXTENSION. ARSON NUMBER 737 CALLED TO SCENE DUE TO UNDETERMINED CAUSE OF FIRE

NO.116

23:54

06/24/02

Station: BOWEN/WHITE HOU AP
 SMC Preliminary Surface Airways (SA) Observations

Time/Date				Temp			Wind			Pressure			Humidity			Clouds			Other					
Day	Month	Year	Time	Temp	Wind	Dir	Temp	Wind	Dir	Pressure	Humidity	Clouds	Other	Day	Month	Year	Time	Temp	Wind	Dir	Pressure	Humidity	Clouds	Other
SA	02	6	21	1	76	74	94			1021.3	10.0	0.00												06:53
REMARKS: A02				CLOUDS: FFW025 SCT250																				
SA	02	6	21	2	76	73	90	320	3	1021.3	10.0	0.00												07:53
REMARKS: A02				CLOUDS: FFW025 SCT250																				
SA	02	6	21	3	76	74	94	40	4	1021.3	10.0	0.00												08:53
REMARKS: A02				CLOUDS: FFW025 SCT250																				
SA	02	6	21	4	76	74	94			1020.9	10.0	0.00												09:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	5	76	73	94			1021.3	9.0	0.00												10:53
REMARKS: A02				CLOUDS: FFW025 SCT250																				
SA	02	6	21	6	76	74	94	360	5	1022.0	10.0	0.00		76	74									11:53
REMARKS: A02				CLOUDS: FFW025 SCT250																				
SA	02	6	21	7	78	75	91	40	4	1022.7	7.0	0.00												12:53
REMARKS: A02				CLOUDS: SCT015 BKN100 BKN250																				
SA	02	6	21	8	80	75	85	60	6	1023.1	10.0	0.00												13:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	9	84	78	74	40	7	1023.9	10.0	0.00												14:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	10	86	74	60	40	7	1022.8	10.0	0.00												15:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	11	87	72	61	30	6	1022.6	10.0	0.00												16:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	12	88	71	57	120	7	1021.7	10.0	0.00		88	76									17:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	13	89	72	57	10	8	1021.1	10.0	0.00												18:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	14	84	75	74	120	8	1020.9	10.0	0.00												19:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	15	89	73	59	150	7	1020.2	10.0	0.00												20:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	16	87	70	57	110	8	1019.9	10.0	0.00												21:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	17	88	71	57	120	7	1019.4	10.0	0.00												22:53
REMARKS: A02				CLOUDS: FFW040 SCT250																				
SA	02	6	21	18	86	72	63	150	7	1019.6	10.0	0.00		90	84									23:53
REMARKS: A02				CLOUDS: FFW040 SCT250																				
SA	02	6	21	19	84	70	63	130	7	1020.2	10.0	0.00												00:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	20	81	70	69	140	4	1020.0	10.0	0.00												01:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	21	80	72	77			1020.6	10.0	0.00												02:53
REMARKS: A02				CLOUDS: FFW025																				
SA	02	6	21	22	80	72	77			1020.9	10.0	0.00												03:53
REMARKS: A02				CLOUDS: FFW025 SCT130 BKN250																				
SA	02	6	21	23	79	73	83			1021.3	10.0	0.00												04:53
REMARKS: A02				CLOUDS: FFW120 SCT250																				
SA	02	6	21	24	78	73	85			1020.7	10.0	0.00		88	77									05:53
REMARKS: A02				CLOUDS: FFW120 SCT250																				
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SOUTHERN REGIONAL CLIMATE CENTER
Louisiana State University
Baton Rouge, LA 70803-4105
Tel: (225) 578-5021
Fax: (225) 578-2912



2402-025-A 10776

Station: HOUSTON/EUSE Tex AP
SRCC preliminary Surface Airways (SA) Observations

(Date/Time)	Temp	Rel	Wx	Dir	Spd	Gst	Slp	Via	Altim	En	6 Hour	Obs
YY MM DD HH	P	%		deg	kt	kt	mb	mi	ft	Cd	Temp	Time
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SA 02 6 21 1	77	76	97	50	3		1021.6	10.0	0.00			06:53
REMARKS: A02												
SA 02 6 21 2	76	76	100		0		1021.0	10.0	0.00			07:53
REMARKS: A02												
SA 02 6 21 3	75	75	100	120	3		1020.9	9.0	0.01			08:53
REMARKS: A02												
SA 02 6 21 4	74	74	100	10	4		1020.9	10.0	0.00			09:53
REMARKS: A02												
SA 02 6 21 5	74	73	97		0		1021.3	10.0	0.00			10:53
REMARKS: A02												
SA 02 6 21 6	73	73	100		0		1021.8	9.0	0.00	77	73	11:53
REMARKS: A02												
SA 02 6 21 7	75	74	97		5		1022.6	10.0	0.00			12:53
REMARKS: A02												
SA 02 6 21 8	75	75	82	50	7		1023.0	10.0	0.00			13:53
REMARKS: A02												
SA 02 6 21 9	82	76	82		3		1022.7	10.0	0.00			14:53
REMARKS: A02												
SA 02 6 21 10	86	74	88		4		1022.6	10.0	0.00			15:53
REMARKS: A02												
SA 02 6 21 11	88	74	83		5		1022.3	10.0	0.00			16:53
REMARKS: A02												
SA 02 6 21 12	89	73	89	40	9		1021.4	10.0	0.00	89	74	17:53
REMARKS: A02												
SA 02 6 21 13	91	73	84	80	9		1020.8	10.0	0.00			18:53
REMARKS: A02												
SA 02 6 21 14	91	70	49	60	9		1020.2	10.0	0.00			19:53
REMARKS: A02												
SA 02 6 21 15	90	72	54	110	10		1019.8	10.0	0.00			20:53
REMARKS: A02												
SA 02 6 21 16	89	71	58	130	10		1019.2	10.0	0.00			21:53
REMARKS: A02												
SA 02 6 21 17	88	73	61	120	10		1019.1	10.0	0.00			22:53
REMARKS: A02												
SA 02 6 21 18	87	73	63	140	8		1018.9	10.0	0.00	92	87	23:53
REMARKS: A02												
SA 02 6 21 19	85	73	67	180	5		1019.7	10.0	0.00			00:53
REMARKS: A02												
SA 02 6 21 20	83	74	74	180	5		1019.4	10.0	0.00			01:53
REMARKS: A02												
SA 02 6 21 21	78	75	81	30	5		1020.5	10.0	0.03			02:53
REMARKS: A02												
SA 02 6 21 22	76	74	54		4		1020.6	10.0	0.00	7		03:53
REMARKS: A02												
SA 02 6 21 23	75	75	97	10	4		1021.0	9.0	0.00			04:53
REMARKS: A02												
SA 02 6 21 24	75	74	97	330	3		1020.6	7.0	0.00	87	75	05:53
REMARKS: A02												
2002 6 21				5.1					0.04	92	73	(24)

SOUTHERN REGIONAL CLIMATE CENTER

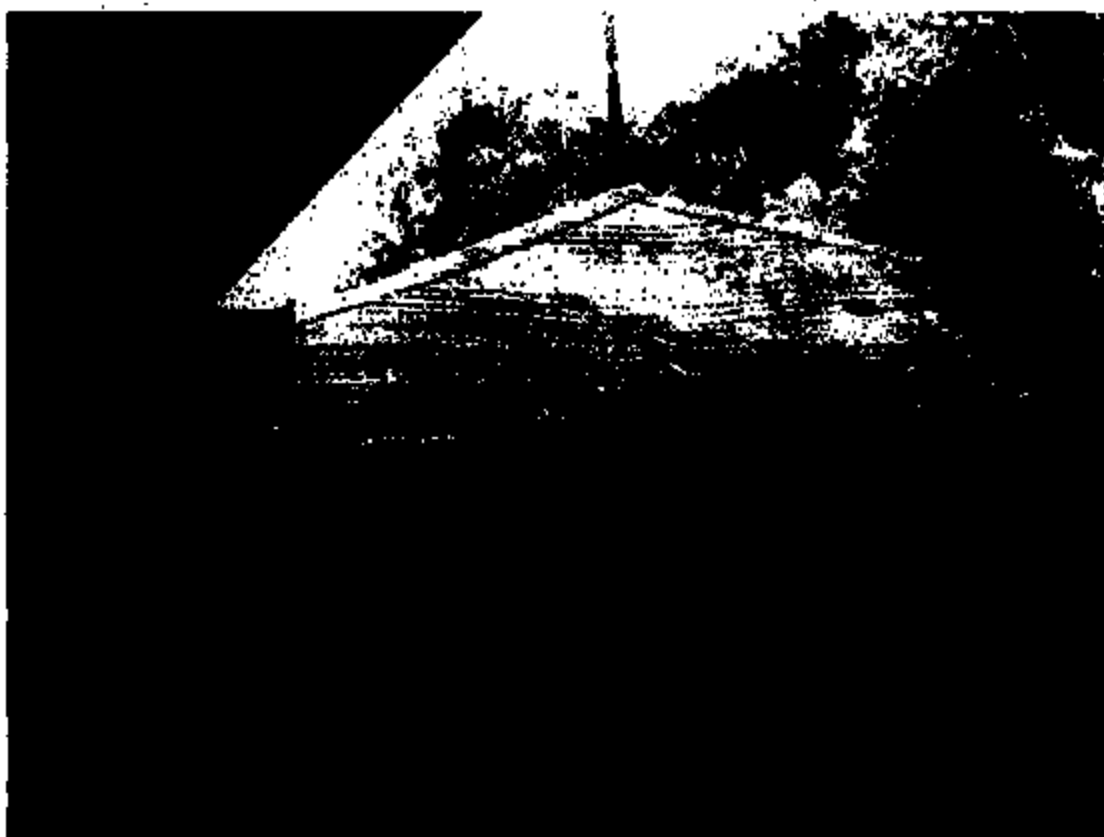
Louisiana State University
Baton Rouge, LA 70803-4105
Tel: (225) 578-5021
Fax: (225) 578-2912



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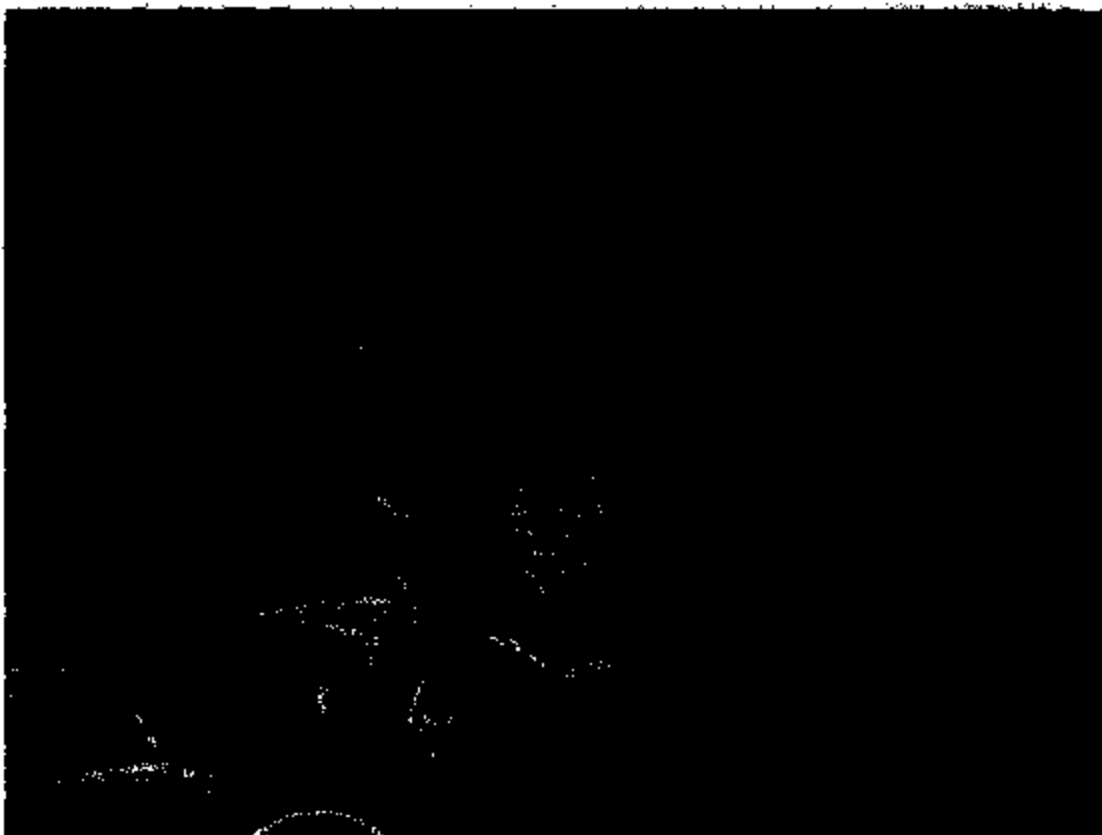






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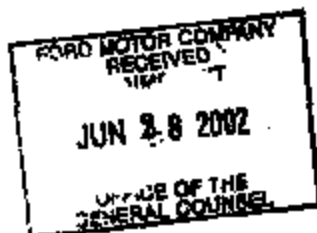




State Farm Insurance Companies



June 25, 2002



State Farm Insurance Companies
NW Freeway CSO Fire Claims
P.O. Box 41349
Houston, Texas 77241
Phone (713) 895-2200
Fax (713) 895-2250

Ford Motor Company
Parklane Towers West
Suite 400
Dearborn, MI 48126-2568

Subject: Claim Number: [REDACTED]
Cause of Loss: Fire
Date of Loss: June 21, 2002

To Whom It May Concern:

This letter is a follow-up to my telephone conversation with a Ford Motor Company representative on June 25, 2002. The case number assigned this matter is 9007469073.

Ford Motor Company is hereby notified as being pursued by State Farm Insurance Companies for subrogation involving a car fire that occurred at our insured's residence on the above date. A 1994 Lincoln Town Car owned by [REDACTED] appears to be where the fire began. Introspect has been hired to conduct a cause and origin investigation and determine why the fire happened.

My concern is the personal property, garage, and home that was damaged as a result of this fire. There is also an auto claim being pursued under the same case number for damages to the vehicle. Formal notification of this has been sent separately.

An inspection of the damaged property, at its current location, by your company is certainly warranted and expected in this situation. A non-destructive inspection will be allowed at the convenience of our policy holder and in the presence of myself and/or another State Farm representative.

HOME OFFICE: BLOOMINGTON, ILLINOIS 61710-0001

REDACTED

ENR2-025 10783 H

Ford Motor Company

June 25, 2002

Page 2

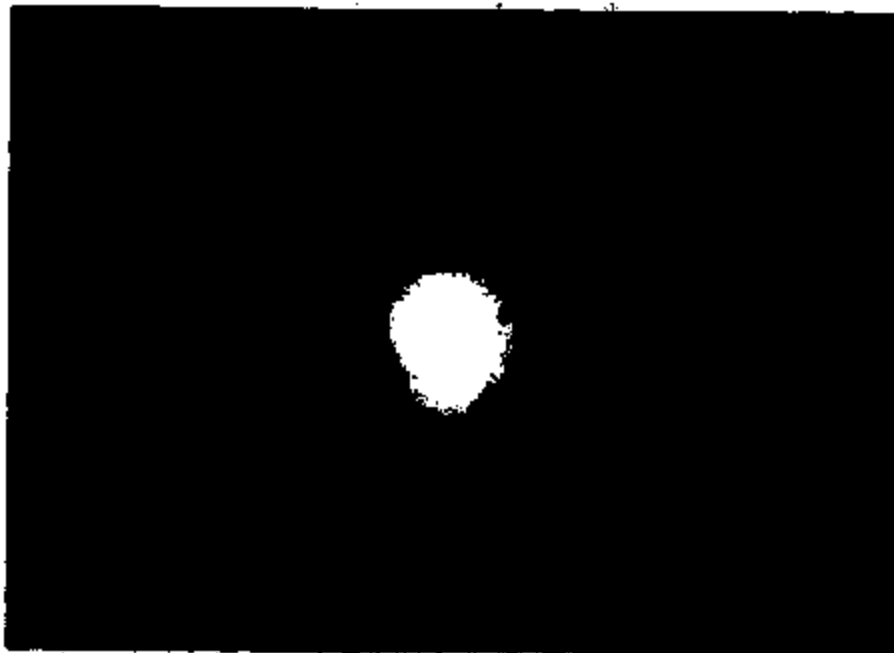
The car will remain at its current location until the first part of next week unless other arrangements are made and agreed upon. Please contact me at the number listed below upon receipt of this letter to schedule an inspection time or address any concerns presented by this case.

Sincerely,



Brandon Sturm
Claim Representative
State Farm Lloyds
(713) 895-2221

Enclosures: None



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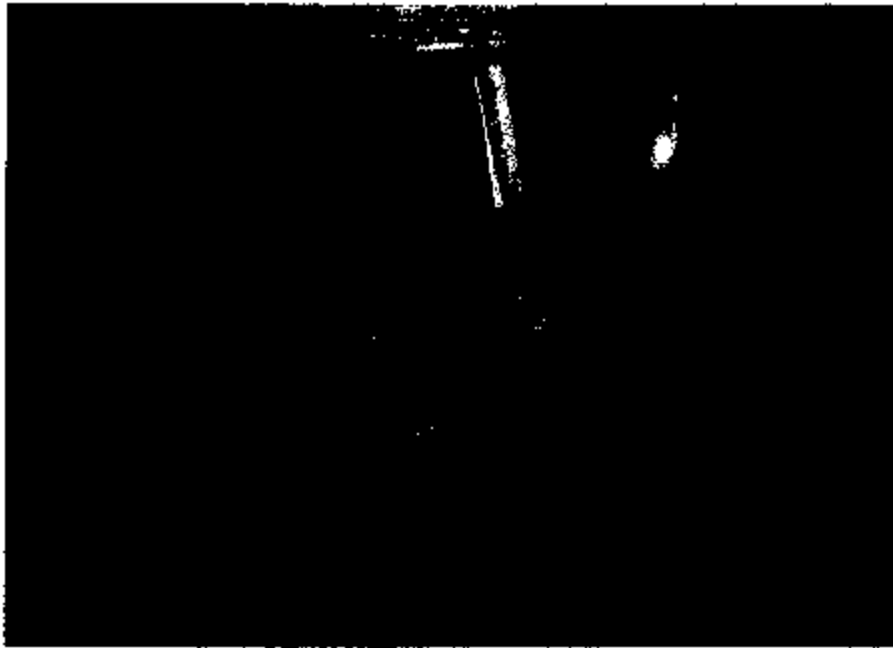
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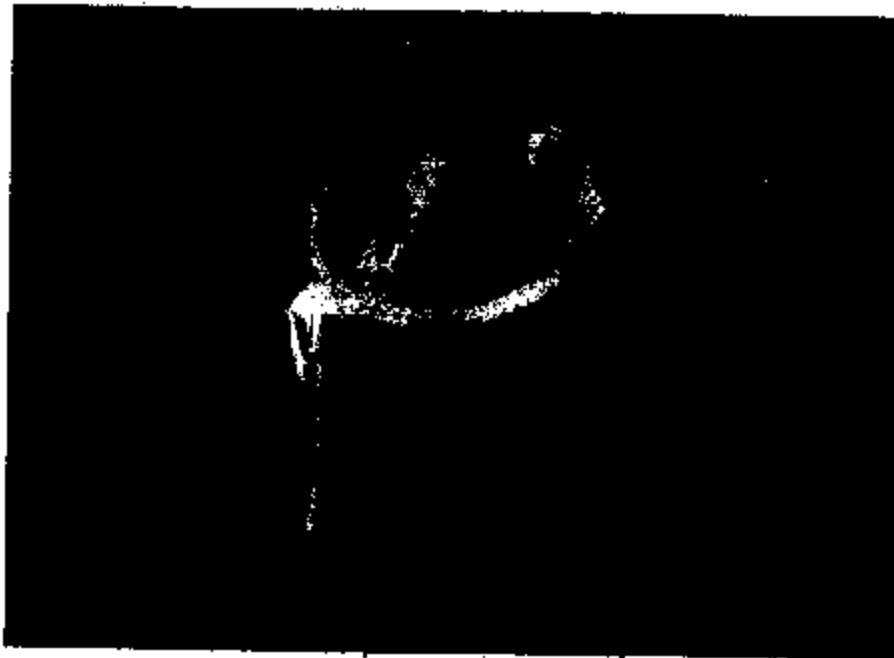
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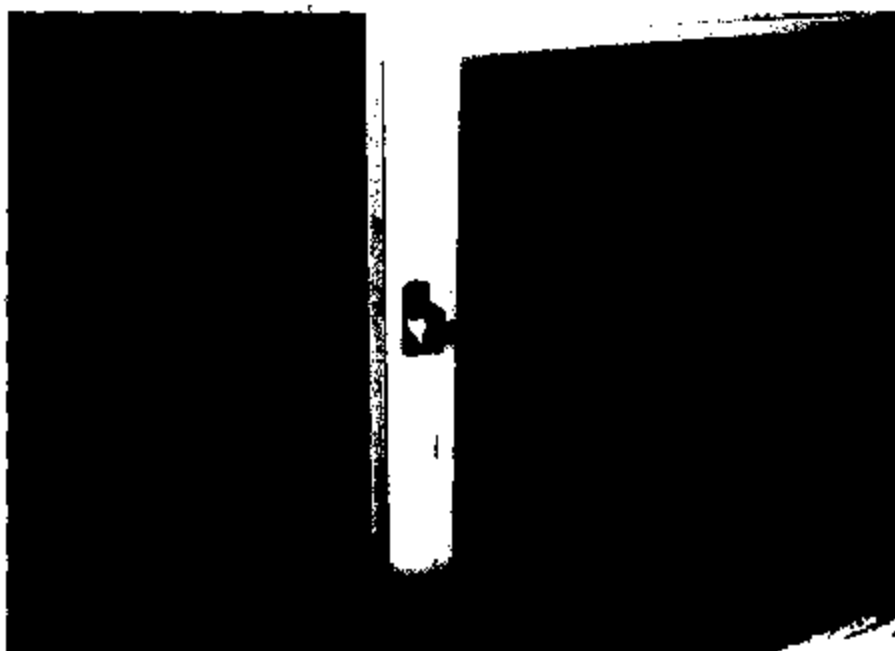
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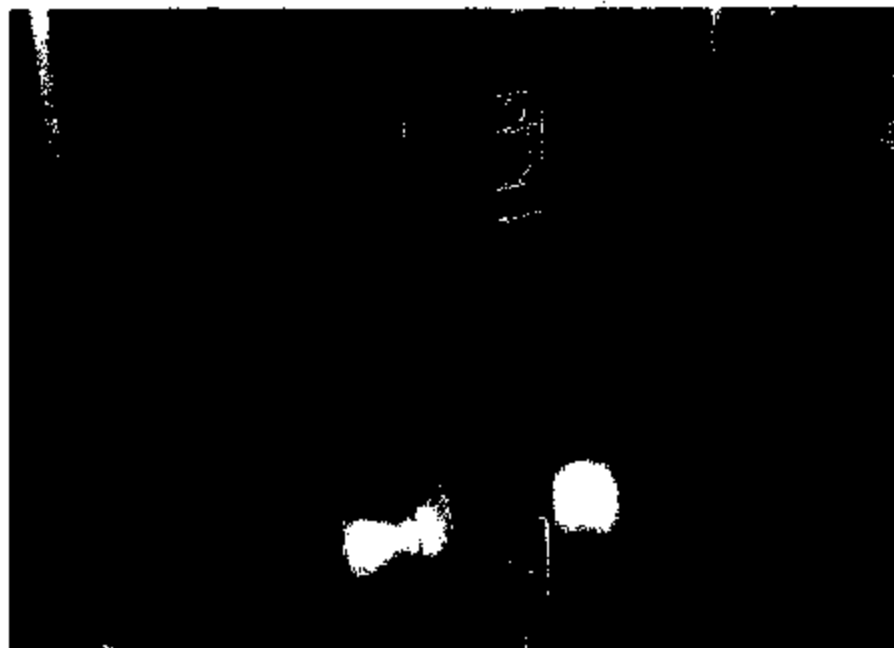
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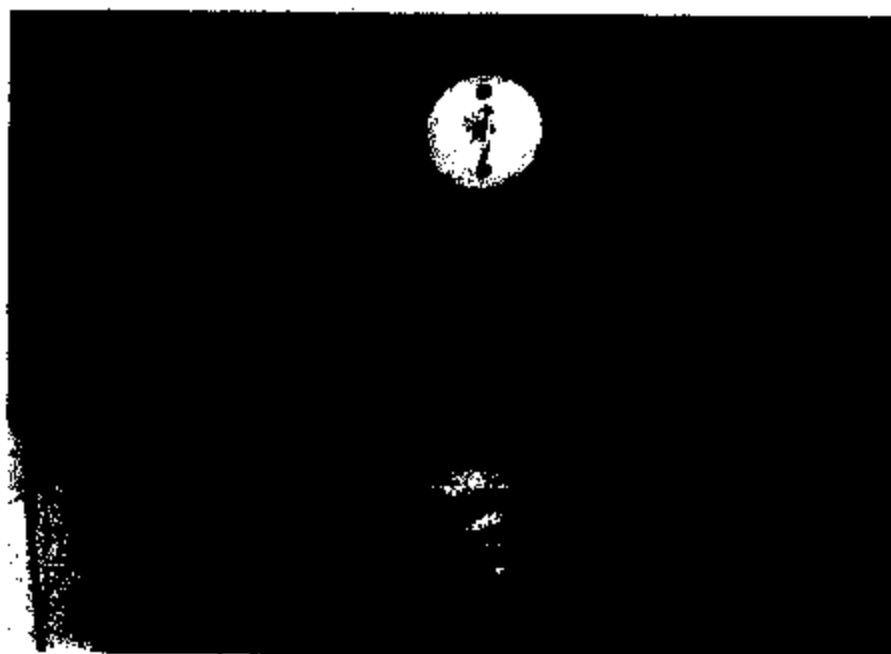
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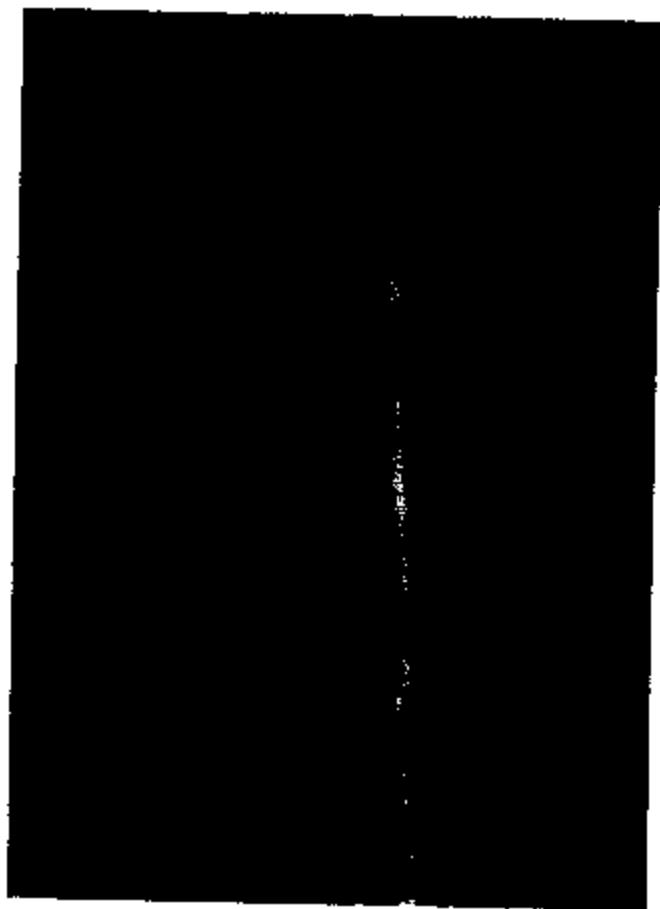
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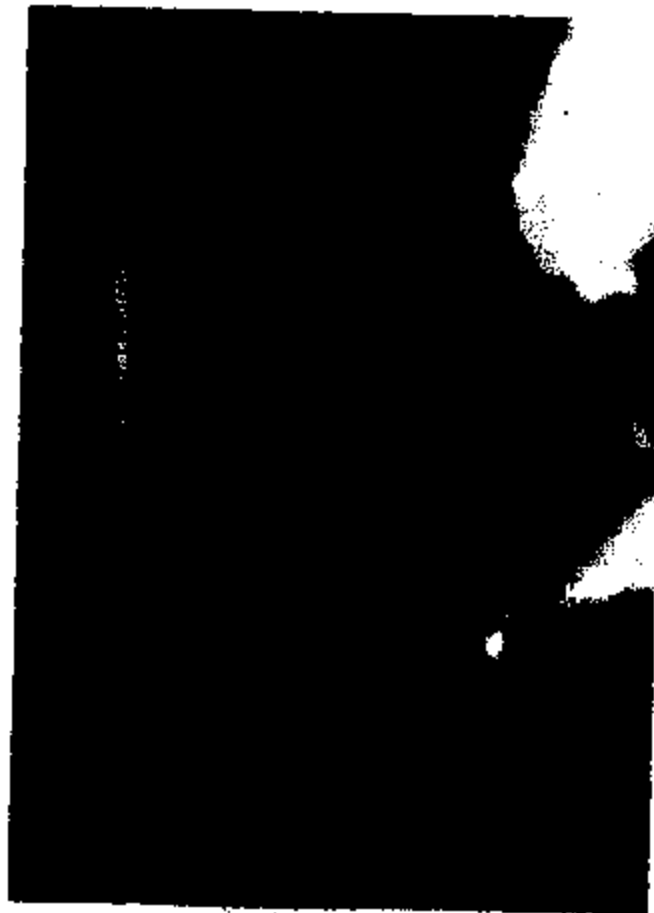
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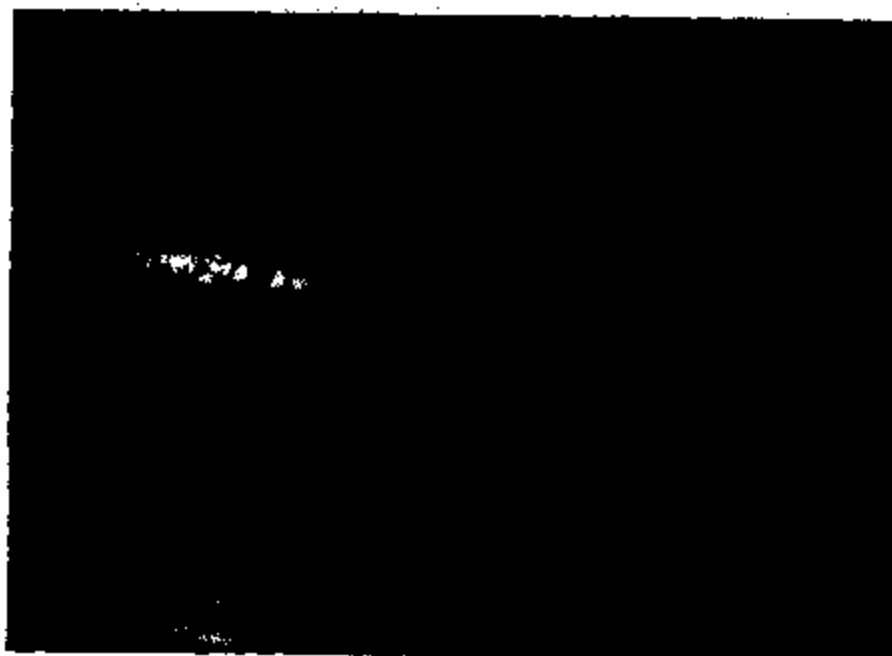
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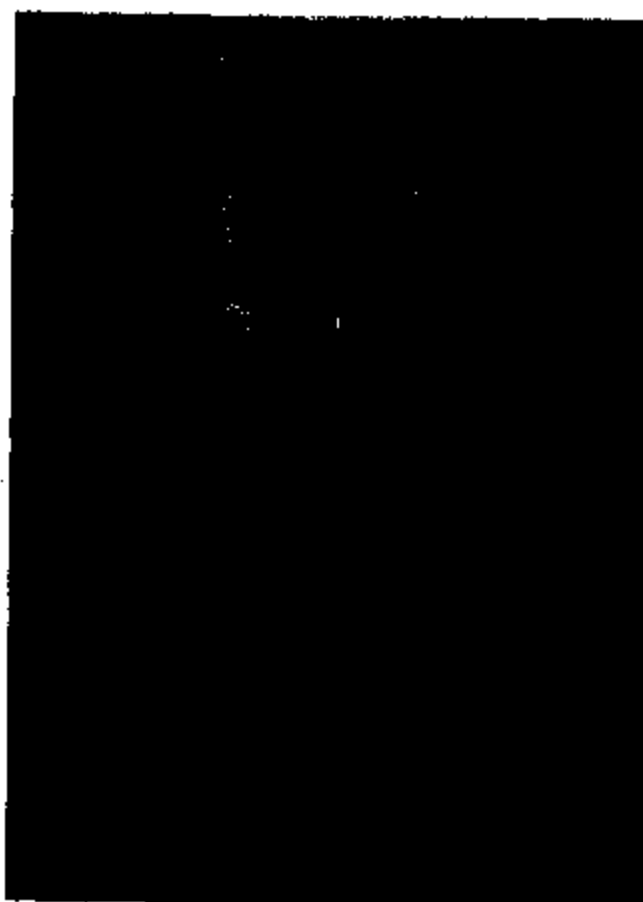
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