

FIRE INVESTIGATION 1A

Fire Cause and Origin Determination



INSTRUCTOR GUIDE



January 2011

Approved and Adopted by the Office of the State Fire Marshal

Recommended for adoption by the Statewide Training and Education Advisory Committee and the State Board of Fire Services



FIRE INVESTIGATION 1A

FIRE ORIGIN AND CAUSE DETERMINATION

INSTRUCTOR GUIDE



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Mission Statement

The mission of State Fire Training is to enable the California fire service to safely protect life and property through education, training, and certification.

California Fire Service Training and Education System

The California Fire Service Training and Education System (CFSTES) was established to provide a single statewide focus for fire service training in California. CFSTES is a composite of all the elements that contribute to the development, delivery, and administration of training for the California Fire Service. The authority for the central coordination of this effort is vested in the Training Division of the California State Fire Marshal's Office with oversight provided by the State Board of Fire Services.

The role of CFSTES is one of facilitating, coordinating, and assisting in the development and implementation of standards and certification for the California fire service. CFSTES manages the California Fire Academy System by providing standardized curriculum and tests; accredited courses leading to certification; approved standardized training programs for local and regional delivery; administering the certification system; and publishing Career Development Guides, Instructors Guides, Student Manuals, Student Supplements, and other related support materials.

This system is as successful and effective as the people involved in it are. It is a fire service system developed by the fire service, for the fire service... and we believe it is the best one in the country.

Acknowledgments

State Fire Training coordinated the development of the material contained in this guide. Before its publication, the Statewide Training and Education Advisory Committee (STEAC) and the State Board of Fire Services (SBFS) recommended this guide for adoption by the State Fire Marshal (SFM). This guide is appropriate for fire service personnel and for personnel in related occupations that are pursuing State Fire Training certification.

Ken Pimlott Acting Director of CAL FIRE	
Tonya Hoover Acting State Fire Marshal	Vacant Assistant State Fire Marshal
Mike Richwine Chief, State Fire Training	Ronny J. Coleman Chair, STEAC



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Special acknowledgement and thanks are extended to the following members of State Fire Training for their diligent efforts and contributions that made the final publication of this document possible.

Alicia Hamilton Fire Service Training Specialist III
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The material contained in this document was compiled and organized through the cooperative effort of numerous professionals within, and associated with, the California fire service.

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California Conference of Arson Investigators
for their support in the completion of this project.

*"We gratefully acknowledge the hard work and accomplishments of those before us
who built the solid foundation on which this program continues to grow."*



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Student Profile

Target Group

Fire fighters, fire investigators, and law enforcement officers assigned to fire investigation.

Prerequisites

None.

Desired Attendance Time Frame

None.



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Class Requirements and Space

The characteristics of the classroom and support facilities have a great impact on the learning environment and the instructor's success or failure. For this course, it is advisable for the instructor to adhere as closely as possible to the following guidelines.

Classroom Equipment

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

Materials

- Course outline
- Calendar of events
- Progress chart
- Individual Activity 2-1: What Does It All Mean?
- Group Activity 5-1: Are You There Legally?
- Group Activity 6-1: Testifying with Body Language
- Group Activity 7-1: What's the Code Section
- Individual Activity 8-1: Scene Sketching
- Group Activity 9-1: Burn Pattern Indicators (Option 1 or 2)
- Group Activity 13-1: What Would I Look For?
- Individual Activity 17-1: What Do You See?
- Formative Test #1 (one copy for each student)
- Formative Test #2 (one copy for each student)
- Formative Test #3 (one copy for each student)
- Instructor-developed Summative Test (one copy for each student)



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Introduction to the Instructor Guide

This publication is intended to serve as an instructor guide. For each topic identified in the course outline, a lesson plan has been developed that contains: a time frame, level of instruction, authority, behavioral objective, materials needed, method of instruction, references, preparation statement, lesson content, and end page. Suggested application methods have been identified throughout the lessons for you to use during your presentation.

- **Time Frame:** The estimated duration required for in-class presentation.
- **Level of Instruction:** Identifies the instructional level that the material was designed to fulfill. You have the latitude to increase the level based on available time, local conditions, and the students' apperceptive base.
- **Authority:** Keyed, when applicable, to the appropriate Certification Training Standard task.
- **Behavioral Objective:** The behavioral objective is a statement of the student's performance desired at the end of instruction. You must ensure that enough information is given in the presentation and/or activities to enable the student to perform according to the goal.
- **Materials Needed:** This should be a complete list of everything you will need to present the lesson, including visual aids, tests, etc.
- **References:** These are the specific references the curriculum development team used when developing the lesson plan. In addition, references may be listed as additional study aids for instructors to enhance the lesson -- books, manuals, bulletins, scripts, visual aid utilization plans and the like.
- **Preparation:** The motivational statement connects the student with the lesson plan topic through examples or illustrations relating to their occupation, injury, and even mortality. You will need to develop this statement to fit your target audience.
- **Lesson Content:** Includes information used in the four-step method of instruction.

Cognitive Lesson Plans

PRESENTATION	APPLICATION
Everything you say or display Content Notes	Student Participation <ul style="list-style-type: none"> • Questions • Activities • Audiovisual Cues

Psychomotor Lesson Plans

OPERATIONS	KEY POINTS
Specific actions to be performed by the students Begin with a verb, followed by a noun	The who, what, when, where, why, and how (the "tricks of the trade") Safety practices



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Appendix A – Formative Test Answer Keys

- Formative tests with the answer key; instructor use only.

Appendix B – Formative Tests

- Formative test masters that must be copied for each student. Keep these in good condition to use for future classes.



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Course Outline

Course Objectives: To provide the student with...

- a) An overview of fire investigative practices and responsibilities associated with fire origin and cause.
- b) Technical information enabling them to determine the area of fire origin.
- c) Background information that will lead them to develop an opinion of the fire causes.
- d) Technical information on the State's arson laws and legal aspects of fire scene investigation.

Course Content.....	40:00
1. Orientation and Administration	1:00
2. The Role of the Fire Investigator	1:00
3. The Scientific Method	1:00
4. Fire Development for the Investigator.....	3:00
5. Legal Aspects of Fire Investigation.....	2:00
6. Expert Testimony.....	1:00
7. Arson Law.....	1:00
8. Fire Scene Documentation	1:00
9. Point of Origin Determination.....	4:00
10. Ignition.....	2:00
11. Accidental Ignition Sources	3:00
12. Electrical Ignition Sources	2:00
13. Incendiary Fire Indicators	3:00
14. Incendiary Devices	2:00
15. Structure Fire Investigation.....	2:00
16. Vehicle Fire Investigation.....	2:00
17. Wildland Fire Investigation.....	2:30
18. Explosion Investigation.....	2:30
Formative Tests.....	3:00
Summative Test.....	1:00



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Texts and References

- Arson Fires in California, CSFM, NFIRS Program, www.osfm.fire.ca.gov/cairs/cairs.php
- California Code of Civil Procedure, Sections 1822.50-1822.57
- California Evidence Code, 2009 Edition, Sections 720–723 and 800-805
- California Fire Code, Sections 104, 104.10 and 104.10.1
- California Health and Safety Code, Sections 13000-13002, 13007, 13100, and 13107
- California Penal Code, Sections 15-17, 26, 450-457.1, 654, 800-801, 1523–1542, 11413, 12301-12303.3, 12308-12312
- California Public Resources Code, Sections 714 and 714(d)
- California Vehicle Code, Section 23111
- Essential Finding - A Study of Serial Arsonists, Federal Bureau of Investigation (FBI), National Center for Analysis of Violent Crime (NCAVC), 1994
- Fire Investigation Handbook, National Insurance Crime Bureau, 1995
- Fire Loss In The United States, NFPA Research Paper, 2008 Edition (Revised 2010)
- Fireline Handbook – Appendix B, NWCG, 2006 Edition
- Forensic Fire Scene Reconstruction, Icove and DeHaan, Second Edition
- <http://definitions.uslegal.com>
- Ignition Handbook, Vytenis Babrauskus PhD, Fire Science Publishers, 2003 Edition
- Investigation & Prosecution of Arson, California District Attorney's Association
- Investigation of Motor Vehicle Fires, Lee S. Cole, 1992
- Investigation of Wildfires, Richard T. Ford, 1995 Edition
- Kirk's Fire Investigation, John DeHaan, Pearson Prentice Hall, 2006, Sixth Edition
- NFPA 921: Guide for Fire and Explosion Investigations, 2008 Edition
- NFPA 1033: Standard for Professional Qualifications for Fire Investigator, 2009 Edition
- Principles of Fire Behavior, James G. Quintiere, 1997 Edition
- State Fire Training Procedures Manual, SFT, Current Edition
- Title 18: USL, Part 1, Crimes, Chapter 40, Section 844
- Vehicle Fire Investigation, California Conference of Arson Investigators, 1994, Workbook and VHS
- Wildfire Origin and Cause Determination Handbook, NWCG, 2005 Edition



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Calendar of Events

DAY	TOPIC	TITLE	TIME	ACTIVITY	EVALUATION
Day 1	1	Orientation and Administration	1:00		
	2	The Role of the Fire Investigator	1:00	2-1	
	3	Scientific Method	1:00		
	4	Fire Development for the Investigator	3:00		
	5	Legal Aspects of Fire Investigation	2:00	5-1	
Day 1 Total			8:00		
Day 2			1:00		Formative Test 1
	6	Expert Testimony	1:00	6-1	
	7	Arson Law	1:00	7-1	
	8	Fire Scene Documentation	1:00	8-1	
	9	Point of Origin Determination	4:00	9-1	
Day 2 Total			8:00		
Day 3			1:00		Formative Test 2
	10	Ignition	2:00		
	11	Accidental Ignition Sources	3:00		
	12	Electrical Ignition Sources	2:00		
Day 3 Total			8:00		
Day 4			1:00		Formative Test 3
	13	Incendiary Fire Indicators	3:00	13-1	
	14	Incendiary Devices	2:00		
	15	Structure Fire Investigation	2:00		
Day 4 Total			8:00		
Day 5	16	Vehicle Fire Investigation	2:00		
	17	Wildland Fire Investigation	2:30	17-1	
	18	Explosion Investigation	2:30		
			1:00		Summative Test
Day 5 Total			8:00		
Course Total			40:00		



FIRE INVESTIGATION 1A

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FIRE INVESTIGATION 1A PROGRESS CHART	BEGINNING DATE:							ENDING DATE:							
CLASS SIZE LIMITED TO 40 STUDENTS	Activity 2-1	Activity 5-1	Activity 6-1	Activity 7-1	Activity 8-1	Activity 9-1 (1)	Activity 9-1 (2)	Activity 13-1	Activity 17-1	Formative Test 1	Formative Test 2	Formative Test 3	Attendance	Summative Test	Pass/Fail
STUDENT IDENTIFICATION															
1.															
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20.															



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

FIRE INVESTIGATION 1A PROGRESS CHART	BEGINNING DATE:							ENDING DATE:							
CLASS SIZE LIMITED TO 40 STUDENTS	Activity 2-1	Activity 5-1	Activity 6-1	Activity 7-1	Activity 8-1	Activity 9-1 (1)	Activity 9-1 (2)	Activity 13-1	Activity 17-1	Formative Test 1	Formative Test 2	Formative Test 3	Attendance	Summative Test	Pass/Fail
STUDENT IDENTIFICATION															
21.															
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40.															



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

Topic: #1: Orientation And Administration

Time Frame: 1:00

Level Of Instruction: Level I

Authority: State Fire Marshal

Behavioral Objective:

Condition: Given an oral evaluation

Behavior: The student will identify the course requirements and objectives

Standard: To the instructor's satisfaction according to the information contained in Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 1-3

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Progress chart

References:

- Fire Investigation 1A Course Outline, 2011 Edition
- State Fire Training Procedures Manual, SFT, Current Edition

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)

Begin

Curiosity (arouse)

Association

Interest (create)

Students

Desire (stimulate)

Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

PRESENTATION	APPLICATION
<p>I. INTRODUCTIONS</p> <ul style="list-style-type: none">A. Introduce self and other staffB. Cite background<ul style="list-style-type: none">1. Fire department experience2. Education3. Training4. Teaching history5. Contact information where instructor can be reached<ul style="list-style-type: none">a) Phone number(s)b) Emailc) OtherC. Orientation<ul style="list-style-type: none">1. Classroom location(s)2. Restrooms3. Food locations4. Smoking locations5. Breaks and break locations6. Lunch times7. Cell phones/pagers<ul style="list-style-type: none">a) Shut-off or vibrateb) Emergencies only8. Parking9. Emergency proceduresD. Student introductions <p>NOTE: Provide slide to remind each student what information to include in the self-introduction.</p> <ul style="list-style-type: none">1. Name2. Department	<p>CLASS ACTIVITY: Students are to introduce themselves.</p>



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PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 3. Rank 4. Years of experience 5. Current assignment 6. Reason(s) for taking Fire Investigation 1A <p>E. Reasons for student introductions</p> <ul style="list-style-type: none"> 1. Introduce self to class 2. Become accustomed to speaking in front of a group 3. Get more at ease and relaxed with new and unfamiliar atmosphere 4. Networking purposes <p>II. COURSE DESIGN</p> <ul style="list-style-type: none"> A. To satisfy portions of the NFPA 1033 standards for Fire Investigator B. To satisfy portions of the NFPA 1021 investigation standards for Fire Officer I, II, and III C. To satisfy one of the educational requirements for State Fire Training's certified Fire Officer D. To satisfy the prerequisites for the Level 2 Fire Investigation series offered by State Fire Training E. To maintain compatibility with other courses offered in State Fire Training's Fire Officer series <p>III. COURSE OBJECTIVES</p> <p>NOTE: From the course objectives in the course outline, Page iii in the student supplement.</p> <ul style="list-style-type: none"> A. An overview of fire investigative practices and responsibilities associated with fire origin and cause B. Technical information enabling them to determine the area of fire origin C. Background information that will lead them to develop an opinion of the fire causes 	<p>Why do we have you introduce yourselves at the beginning of a class in this manner?</p>



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PRESENTATION	APPLICATION
<p>D. Technical information on the State's arson laws and legal aspects of fire scene investigation</p> <p>IV. COURSE TOPICS</p> <p>A. Eighteen topics</p> <p>NOTE: From the course content in the course outline, Page iii in the student supplement and the calendar of events on Page iv.</p> <ol style="list-style-type: none">1. Orientation and Administration2. The Role of the Fire Investigator3. The Scientific Method4. Fire Development for the Investigator5. Legal Aspects of Fire Investigation6. Expert Testimony7. Arson Law8. Fire Scene Documentation9. Point of Origin Determination10. Ignition11. Accidental Ignition Sources12. Electrical Ignition Sources13. Incendiary Fire Indicators14. Incendiary Devices15. Structure Fire Investigation16. Vehicle Fire Investigation17. Wildland Fire Investigation18. Explosion Investigation <p>V. COURSE REQUIREMENTS</p> <p>A. Attendance</p> <ol style="list-style-type: none">1. 40 hours2. State Fire Training policy requires every student to attend the entire class	



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PRESENTATION	APPLICATION
<ul style="list-style-type: none"> a) Excused absences may be considered for emergencies 3. If there is a problem with meeting this requirement, consider enrolling at another date when you can commit the time required B. Classroom and group participation are required C. Required text <ul style="list-style-type: none"> 1. <u>NFPA 921: Guide for Fire & Explosion Investigations</u>, 2008 Edition 2. <u>Fire Investigation 1A Student Supplement</u>, SFT, 2011 Edition <ul style="list-style-type: none"> a) Ancillary material not in the required NFPA text <p>VI. STUDENT EVALUATION</p> <ul style="list-style-type: none"> A. There will be three formative tests <ul style="list-style-type: none"> 1. Each will be followed by a group discussion and review <ul style="list-style-type: none"> a) Tests must be returned to the instructor after the review 2. Test scores will count toward your final grade 3. Must take all tests B. Grades issued on point system <ul style="list-style-type: none"> 1. Minimum 80% required on tests 2. Completion of activities 3. Attendance C. Progress chart <ul style="list-style-type: none"> 1. Uses student identification numbers instead of names 2. Federal law prohibits publication of identifiable student grades D. Summative test <ul style="list-style-type: none"> 1. Instructor developed 2. Minimum 50-item test 	



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PRESENTATION	APPLICATION
<p>3. Format will be either completion, short-answer, and/or multiple choice</p> <p>4. Minimum 80% passing score in order to pass the class</p> <p> a) If a student fails the summative test, he or she fails the class and does not meet the prerequisite to attend the next Fire Investigation class</p> <p>5. Retake a summative test</p> <p> a) The Primary Instructor may elect to administer a retake exam</p> <p> b) Must be administered prior to returning the class materials to SFT</p> <p> 1) Within 15 days of the class ending date</p> <p>VII. CFSTES CERTIFICATION</p> <p>A. Fire Officer certification</p> <p> 1. Successful completion of Fire Investigation 1A meets the investigation training course requirements</p> <p>B. Fire Investigator certification (formerly Fire Investigator I)</p> <p> 1. Successful completion of Fire Investigation 1A and Fire Investigation 1B meets the investigation training course requirements</p> <p>C. For complete certification requirements for Fire Officer and Fire Investigator, refer to <u>State Fire Training Procedures Manual</u>, SFT, Current Edition</p> <p> 1. Go to <i>http://sft.fire.ca.gov</i></p> <p> 2. Access the document on the left margin</p> <p>VIII. CAPSTONE TESTING</p> <p>A. Capstone testing is a comprehensive certification exam process</p> <p>B. The test is administered upon completing all requirements for the certification level</p>	<p>What is capstone testing?</p>



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Fire Cause and Origin Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 1. Administered on a regular basis at approved sites throughout the state C. Confirms verification of knowledge, skills, and abilities for the Fire Investigator certification level D. Process <ul style="list-style-type: none"> 1. Candidate completes the Fire Investigator Capstone Testing Task Book <ul style="list-style-type: none"> a) Singular place to capture and verify tasks required for certification 2. After the task book is complete, candidate registers with the testing site to take the written capstone test <ul style="list-style-type: none"> a) Morning session b) Afternoon session 3. Candidate arrives at the testing site to take the written capstone test 4. SFT reviews the candidate's task book <ul style="list-style-type: none"> a) Your original Capstone Test Task Book b) Keep a copy for your records 5. If complete, candidate applies for certification <ul style="list-style-type: none"> a) An Application for Capstone Testing requesting Fire Investigator certification b) Payment of the certification/capstone testing fee <ul style="list-style-type: none"> 1) Fee is nonrefundable 6. Certification <ul style="list-style-type: none"> a) If the candidate is successful, will receive Fire Investigator certificate b) If the candidate is unsuccessful, the test can be retaken after 30 days <ul style="list-style-type: none"> 1) Additional fee will apply E. These components are the initial steps in fulfilling the Blueprint 20/20, California State Fire Training and Education Strategic Plan 2008 with respect to capstone testing 	



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Fire Cause and Origin Determination

Summary:

This course was designed around the responsibilities of the fire investigator at a fire scene. We have discussed the course direction and set-up, minimum materials required for the class, attendance, and certification rules.

Evaluation:

The student will complete the oral evaluation at a time determined by the instructor.

Assignment:

Review your notes and read Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 1-3 in order to prepare yourself for the upcoming test. Study for our next session.



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Topic:	#2: The Role Of The Fire Investigator
Time Frame:	1:30
Level Of Instruction:	Level II
Authority:	2009 Fire Investigator CTS #1: The Role Of The Fire Investigator
Behavioral Objective:	
Condition:	Given an activity, formative test, and summative test
Behavior:	The student will describe the fire problem in the United States and its impact on fire investigation, including importance of fire investigation and
Standard:	With a minimum 80% accuracy on the formative and summative tests according to the information contained in <u>NFPA 921: Guide to Fire & Explosion Investigations</u> , 2008 Edition, Chapter 1: Administration, Page 921-7, Sections 1.1-1.3.5 and Chapter 3: Definitions, Pages 921-11 through 921-16, Sections 3.1-3.3.180, <u>Fire Investigation 1A Student Supplement</u> , SFT, 2011 Edition, Pages 4-18, and successfully completing Individual Activity 2-1
Materials Needed:	<ul style="list-style-type: none">• Conference board/pads with markers/erasers• Appropriate audiovisual training aids and devices• Individual Activity 2-1: What Does It All Mean?
References:	<ul style="list-style-type: none">• "Arson Fires in California," CSFM, NFIRS Program, www.osfm.fire.ca.gov/cairs/cairs.php• <u>California Fire Code</u>, Section 104• <u>California Health and Safety Code</u>, Section 13107• <u>California Public Resource Code</u>, Section 714(d)• <u>NFPA 921: Guide to Fire & Explosion Investigations</u>, 2008 Edition, Chapter 1: Administration, Page 921-7, Sections 1.1-1.4 and Chapter 3: Definitions, Pages 921-11 through 921-16, Sections 3.1-3.3.180• <u>NFPA 1033: Standard for Professional Qualifications for Fire Investigator</u>, 2009 Edition• <u>Fire Loss In The United States</u>, NFPA Research Paper, 2008 Edition (Revised 2010)
Preparation:	Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.



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Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

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PRESENTATION	APPLICATION
<p>I. FIRE INVESTIGATION IS THE CORNERSTONE OF THE FIRE PROTECTION PROCESS</p> <ul style="list-style-type: none"> A. Until it is known what starts fire, little specific corrective action can be taken by the fire protection process in stopping fires before they start B. The fire investigation is a tedious time consuming process tracing the fire through its destruction to arrive at the origin and determine the cause C. Once the cause is determined corrective action to prevent future occurrences can be taken <p>II. FIRE LOSS IN THE UNITED STATES (NFPA)</p> <ul style="list-style-type: none"> A. Property damage due to fires in the United States is staggering, and loss of life and injuries are alarming B. 2008 National Fire Protection Association (NFPA) report <ul style="list-style-type: none"> 1. U.S. fire departments responded to an estimated 1,451,500 fires <ul style="list-style-type: none"> a) 3,320 civilian fire fatalities b) 6,705 civilian fire injuries c) Estimated \$15,478,000,000 in direct property loss <ul style="list-style-type: none"> 1) Includes the California wildfires with an estimated property loss of \$1,400,000,000 2. Civilian fire death every 158 minutes 3. Civilian fire injury every 31 minutes 4. Home fires caused 2,755, or 83%, of the civilian fire deaths 5. Fires accounted for six percent of the 25,252,500 total calls C. Intentionally set fires <ul style="list-style-type: none"> 1. Estimated 30,500 intentionally set structure fires in 2008, a decrease of 6.2% 2. 315 civilian deaths, an increase of 6.8% 3. \$866,000,000 in property loss, an increase of 18.2% 	



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Fire Cause and Origin Determination

PRESENTATION	APPLICATION
<p>4. 17,500 intentionally set vehicle fires occurred</p> <ol style="list-style-type: none"> a) No change from a year ago b) Caused \$139,000,000 in property damage, a decrease of 4.1% <p>D. 2008 arson fires in California</p> <ol style="list-style-type: none"> 1. CAL FIRE/OSFM National Fire Incident Reporting System (NFIRS) 2. 10% of reported fire incidents are arson or incendiary in nature 3. Estimated 18% of fire dollar loss is a result of arson fires <p>NOTE: Discuss statistics and how they can be subjective, are meant to provide an idea of what the status of the subject matter is, and how the numbers can change dependent upon interpretation, input, submission of information, etc.</p> <p>Check NFPA and OSFM website annually for updates to the figures presented above.</p> <p>III. WHY FIRES ARE INVESTIGATED</p> <ol style="list-style-type: none"> A. To determine the cause <ol style="list-style-type: none"> 1. Future fires can be averted and possible injuries avoided B. To determine if the circumstances involving the fire were in compliance with any applicable fire code <ol style="list-style-type: none"> 1. Evaluate for the effectiveness of existing fire codes 2. Determine the need for upgrades an/or changes to the code C. To determine if the fire cause could be related to a product malfunction or defect 	<p>What are some reasons for conducting a fire investigation?</p>



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

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<p>D. To determine if the fires are the result of a criminal act</p> <p>E. In the civil area, fires are investigated to determine if there are any subrogation issues</p> <p>IV. FIRE DEPARTMENT ORGANIZATION</p> <p>A. Investigation responsibilities/authority</p> <ol style="list-style-type: none"> 1. A direct responsibility of the fire service 2. Uniform Fire Code or other local ordinance 3. Must accurately identify origin and cause of the fire 4. Develop a strong working relationship with local law enforcement <p>B. Fire origin and cause vs. arson investigation</p> <ol style="list-style-type: none"> 1. Fire investigator <ol style="list-style-type: none"> a) Determines origin and cause b) May conduct civil and criminal follow-up 2. Fire-arson investigator <ol style="list-style-type: none"> a) Investigates suspicious fires to determine if arson is the cause b) Conduct criminal follow-up <p>C. Arson investigation responsibilities</p> <ol style="list-style-type: none"> 1. Fire department 2. Law enforcement agency 3. Combination of fire and law enforcement <p>D. Traditionally, fire departments have addressed the fire situation through suppression, prevention, and investigation</p> <ol style="list-style-type: none"> 1. Bulk of resources assigned to extinguishment 	<p>What are some differences between a fire investigator and an arson investigator?</p>



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

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<p>2. Fire prevention personnel are involved with building plan review, issuance of permits and code enforcement</p> <p>3. Fire investigation responsibilities carried out on a part-time basis by either suppression or prevention personnel</p> <p>E. A line officer or prevention inspector could be assigned to investigate an incident</p> <p>1. Initially conducted by the first-in officer or the incident commander</p> <p> a) May delegate to personnel with specialized training</p> <p>2. Some local agencies may request a full-time investigator that specializes in the fire scene examination</p> <p> a) Common to see a response matrix that requires a certified or full-time fire investigator when pre-identified events occur</p> <p> 1) A fire where a death or serious injury has occurred</p> <p> 2) An explosion or the presence of evidence associated with an incendiary fire</p> <p> 3) Estimated dollar loss is above a certain threshold</p> <p> 4) Multiple fires with similar modus operandi (MOs)</p> <p>V. PUBLIC SECTOR FIRE INVESTIGATORS</p> <p>A. Federal investigators</p> <p>1. Public sector fire investigators work for federal, state, or local agencies</p> <p>2. Alcohol, Tobacco, Firearms, and Explosives (ATF) is the primary federal agency with fire investigation responsibilities</p>	<p>What constitutes a public sector investigator?</p>



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Fire Cause and Origin Determination

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<ul style="list-style-type: none"> a) Authority assigned to the Bureau of Alcohol, Tobacco and Firearms derives from the U.S. Code, Title 18, Part I, Chapter 40 b) Assistance provided to local agencies through National Response Team (NRT) c) Individual agents that are Certified Fire Investigators (CFI) assigned to offices throughout the United States <p>3. Federal Bureau of Investigation (FBI)</p> <ul style="list-style-type: none"> a) Normally associated with terrorist activities <p>4. Other federal employees conduct fire investigations as authorized by the U.S. Code</p> <ul style="list-style-type: none"> a) U.S. Forest Service b) Bureau of Land Management c) National Park Service <p>B. State investigators</p> <ul style="list-style-type: none"> 1. Employees of the California Department of Forestry and Fire Protection (CAL FIRE) are empowered to conduct fire investigations by Public Resource Code Section 714(d) 2. Health and Safety Code Section 13107 also authorizes these employees to investigate fires and explosions on state property and to assist local agencies <p>C. Local agency investigators</p> <ul style="list-style-type: none"> 1. The 2007 California Fire Code Section 104 authorizes the Fire Chief to enforce the fire code, which includes the investigation of the cause, origin, and circumstances of fire 2. Section 104.10 of that same code authorizes a fire department to investigate promptly the cause, origin, and circumstances of every fire occurring in the jurisdiction involving loss of life or injury to person or destruction or damage to property 	



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

PRESENTATION	APPLICATION
<p>a) If the fire appears of incendiary origin, investigators are authorized to take immediate charge of all physical evidence related to the cause and to pursue the investigation to its conclusion</p> <p>3. Section 104.6 requires a fire department to retain official records for not less than five years</p> <p>a) Showing cause and findings of each investigation</p> <p>VI. PRIVATE SECTOR INVESTIGATOR</p> <p>A. Can be independent contractors, employees of the independent contractor, or can work for an insurance company</p> <p>1. May perform services for</p> <p>a) Insurance companies</p> <p>b) Law firms</p> <p>c) Product manufacturers</p> <p>d) Utility companies</p> <p>e) Public adjustors</p> <p>f) Victim(s) of the fire to represent the owner or occupant's interest</p> <p>g) Companies that specialize in the analysis of failures of products and appliances</p> <p>B. In California, can become a certified fire investigator (CFI) by complying with the certification requirements of either the California Conference of Arson Investigators (CCAI) or the International Association of Arson Investigators (IAAI)</p> <p>1. May previously served in the public sector and received their certification from the State Fire Marshal while working for a public agency</p>	<p>What constitutes a private sector investigator?</p>



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

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<p>VII. AGENCIES INVOLVED WITH FIRE INVESTIGATION, TRAINING, AND STANDARDS</p> <p>A. NFPA</p> <ol style="list-style-type: none">1. Developed a guide for fire investigation prepared by the Technical Committee on Fire Investigations<ol style="list-style-type: none">a) <u>NFPA 921 Guide for Fire and Explosion Investigations</u>, 2008 Editionb) Approved as an American National Standard on December 31, 20072. Developed a standard for Fire Investigator qualifications prepared by the Technical Committee on Professional Qualifications<ol style="list-style-type: none">a) <u>NFPA 1033 Standard for Professional Qualifications for Fire Investigator</u>, 2009 Editionb) Approved as an American National Standard on July 18, 2008 <p>B. National Fire Academy (NFA)</p> <ol style="list-style-type: none">1. Located at Emmitsburg, Maryland2. Operated under authority of the United States Fire Administration (USFA)3. Courses of study include basic fire/arson investigation and classes for supervisors <p>C. State Fire Training (SFT)</p> <ol style="list-style-type: none">1. Under the direction of the State Fire Marshal, coordinates development of curricula and sets standards for certification as a Fire Investigator <p>D. National Institute of Standards and Technology (NIST)</p> <ol style="list-style-type: none">1. Branch of the U.S. Department of Commerce2. Fire Research Division<ol style="list-style-type: none">a) Develops, verifies, and utilizes measurements and predictive methods to quantify the behavior of fire and means to reduce the impact of fire on people, property, and the environment	



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Fire Cause and Origin Determination

PRESENTATION	APPLICATION
<p>b) Involves integration of laboratory measurements, verified methods of prediction, and large-scale fire experiments to demonstrate the use and value of the research products</p> <p>NOTE: Review Activity 2-1 with the class.</p> <p>VIII. INVESTIGATOR ETHICS</p> <p>A. Investigators are traditionally considered truth finders</p> <ol style="list-style-type: none"> 1. Approach is one of gathering information and developing a hypothesis as to what had occurred 2. Should not have any preconceived conclusion prior to the evaluation of all the facts and physical evidence <p>B. CCAI has developed an appropriate code of ethics</p> <ol style="list-style-type: none"> 1. I will, as an arson investigator, regard myself as a member of an important and honorable profession 2. I will conduct both my personal and professional life so as to inspire the confidence of the public 3. I will not use my position of trust in the California Conference of Arson Investigators for personal advantage or profit 4. I will regard my fellow investigators with the same standards as I hold for myself <ol style="list-style-type: none"> a) I will never betray a confidence, nor otherwise jeopardize their investigation 5. I will regard it my duty to know my work thoroughly <ol style="list-style-type: none"> a) I will make it my further duty to avail myself of every opportunity to learn more about my profession 	<p>CLASS ACTIVITY: Complete Individual Activity 2-1.</p> <p>How are ethics linked to an investigator?</p>



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Fire Cause and Origin Determination

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<p>6. I will avoid alliances with those whose goals are inconsistent with an honest and unbiased investigation</p> <p>7. I will make no claim to professional qualifications which I do not possess</p> <p>8. I will share all publicity equally with my fellow investigators, whether such publicity is favorable or unfavorable</p> <p>9. I will be loyal to my superiors, to my subordinates and to the organizations I represent</p> <p>10. I will always bear in mind that I am a truth seeker; not a case maker, that it is more important to protect the innocent than to convict the guilty</p> <p>11. I will at all times remember the importance of honesty within my profession</p> <p>C. The issue of being unbiased and remaining neutral as information and data is gathered cannot be over emphasized</p> <p>IX. INVESTIGATOR ORGANIZATIONS</p> <p>A. Maintain proficiency and remain current with investigation methodology, fire protection technology, and code requirements</p> <ol style="list-style-type: none"> 1. Seminars and workshops 2. Professional journals and publications 3. Professional organizations <ol style="list-style-type: none"> a) Questioned during the voir dire examination to qualify as an expert witness <p>B. Fire investigation training process</p> <ol style="list-style-type: none"> 1. Often fragmented with little or no cohesive training requirements 2. Courts have held that the fire investigation process must be founded on scientific principles, and that scientific based fire investigation training is needed 3. Fire and arson associations provide training for fire and arson investigators 	



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Fire Cause and Origin Determination

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<ul style="list-style-type: none">4. Worldwide organizations<ul style="list-style-type: none">a) International Association of Arson Investigators (IAAI)<ul style="list-style-type: none">1) Web site, webinars2) CFITrainer.net3) Annual training conferenceb) International Association of Bomb Technicians and Investigators (IABTI)<ul style="list-style-type: none">1) Web site2) Annual international training conference3) Regional training conferences5. State organizations<ul style="list-style-type: none">a) California Conference of Arson Investigators (CCAI)<ul style="list-style-type: none">1) Web site2) Bi-annual training conferences3) Regional roundtable meetings and training sessionsb) State Fire Training (SFT)6. Local organizations <p>C. Local fire investigation task forces</p> <p>X. THE TASK FORCE APPROACH</p> <p>A. During the 1970s, the problem of arson reached epidemic proportions throughout the country</p> <ul style="list-style-type: none">1. Congress commissioned a study entitled "America Burning"<ul style="list-style-type: none">a) Shortcomings regarding how public agencies were handling the problem as well as deficiencies with training were identified <p>B. Agency responsibility (handling the problem)</p> <ul style="list-style-type: none">1. Law enforcement agencies believed they did not have the expertise to handle a fire scene<ul style="list-style-type: none">a) Identified arson as a fire department problem	



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Fire Cause and Origin Determination

PRESENTATION	APPLICATION
<p>D. Lack of standardized training</p> <ol style="list-style-type: none">1. National Fire Academy was established and specific curriculum dealing with fire and arson investigation was implemented<ol style="list-style-type: none">a) Standardized course of instruction nationwide2. The NFA course and courses developed by SFT brought professionalism and consistency to fire investigation <p>XI. PROFESSIONAL QUALIFICATIONS</p> <p>A. NFPA</p> <ol style="list-style-type: none">1. <u>NFPA 1033 Standard for Professional Qualifications for Fire Investigator</u>, 2009 Edition<ol style="list-style-type: none">a) Attributes and training necessary to meet the professional level of job performance <p>B. OSFM/SFT</p> <ol style="list-style-type: none">1. Developed the <u>Fire-Arson Investigator Certification Training Standards</u> (CTS)<ol style="list-style-type: none">a) Based on NFPA 1033b) Additional requirements addedc) First certification level is Fire Investigatord) Second certification level is Fire-Arson Investigator	



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

Summary:

Fire investigation as a discipline within the fire service has been constantly evolving. Fires are investigated to determine their cause to avoid a reoccurrence of the event. The authorization to conduct the fire investigation can come from federal, state or local statutes. The investigation of a fire must be done systematically and performed by individuals that are properly trained.

Evaluation:

The student will complete the activity, formative test, and summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire & Explosion Investigations, NFPA, 2008 Edition, Chapter 1: Administration, Page 921-7, Sections 1.1-1.3.5 and Chapter 3: Definitions, Pages 921-11 through 921-16, Sections 3.1-3.3.180, and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 4-18 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

INDIVIDUAL ACTIVITY 2-1: WHAT DOES IT ALL MEAN?

Time: 0:30

- Materials Needed:**
- NFPA 921: Guide to Fire & Explosion Investigations, NFPA, 2008, Chapter 3: Definitions, Pages 921-11 through 921-16
 - Fire Investigation 1A Student Supplement, SFT, 2011, Glossary
 - Pen or pencil

Introduction: This activity provides the students the opportunity to become familiar with the terms used in fire investigation.

- Directions:**
1. Using the glossary in the student supplement and the definitions in NFPA 921, solve the crossword puzzle below.
 2. You have 20 minutes to complete this step.
 3. Be prepared to discuss your results with the class.



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

Across

- 2** The assumption by a third party (insurance company) of another's legal right to collect a debt or damages.
- 3** The column of hot gases, flames, and smoke rising above a fire.
- 4** Black particles of carbon produced in a flame.
- 7** A body or stream of gaseous material involved in the combustion process and emitting radiant energy at specific wavelength bands determined by the combustion chemistry of the fuel.
- 8** The shattering effect of an explosion.
- 10** A transition phase in the development of a compartment fire in which surfaces exposed to thermal radiation reach ignition temperature more or less simultaneously and fire spreads rapidly throughout the space, resulting in full room involvement or total involvement of the compartment or enclosed space.
- 11** Combustion without flame, usually with incandescence and smoke.
- 12** Any arrangement of material used to start a fire or explosion.
- 13** The process of air or gases being drawn into a fire, plume, or jet.
- 15** Carbonaceous material that has been burned or pyrolyzed and has a blackened appearance.
- 16** The systematic process of removing debris from the top down and observing the relative location of artifacts at the fire scene.
- 17** The actual point of detonation of an explosive at the scene.
- 19** A form of energy characterized by vibration of molecules and capable of initiating and supporting chemical changes and changes of state.
- 20** The decomposition of material by the application of heat and oxidation.

Down

- 1** The fundamental facts necessary to prove the elements of a crime (two words).
- 2** The airborne solid and liquid particulates and gases evolved when a material undergoes pyrolysis or combustion, together with the quantity of air that is entrained or otherwise mixed into the mass.
- 3** The chemical decomposition of a compound into one or more other substances by heat alone; pyrolysis often precedes combustion.
- 5** A rapid oxidation process, which is a chemical reaction resulting in the evolution of light and heat in varying intensities.
- 6** The weight of a substance per unit volume, usually specified at standard temperature and pressure.
- 7** The condition where unburned fuel (pyrolysate) from the originating fire has accumulated in the ceiling layer to a sufficient concentration that it ignites and burns; can occur without ignition of, or prior to, the ignition of other fuels separate from the origin.
- 9** A fuel or oxidizer, often an ignitable liquid, used to initiate a fire or increase the rate of growth or spread of fire.
- 14** The process of initiating self-sustained combustion.
- 17** A rounded globule of re-solidified metal at the end of the remains of an electrical conductor that was caused by arcing and is characterized by a sharp line of demarcation between the melted and unmelted conductor surfaces.
- 18** A moving particle of solid material that emits radiant energy due either to its temperature or the process of combustion on its surface.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #3: The Scientific Method

Time Frame: 1:00

Level of Instruction: Level I

Authority: 2009 Fire Investigator CTS #2: The Scientific Method

Behavioral Objective:

Condition: Given a formative and summative test

Behavior: The student will describe the scientific method, including its seven steps, the difference between inductive and deductive reasoning, and the procedure for selecting the final hypothesis

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 4: Basic Methodology, Pages 921-16 and 921-17, Sections 4.1-4.5

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Forensic Fire Scene Reconstruction, Icove and DeHaan, Second Edition, Pages 2-6
- NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 4: Basic Methodology, Pages 921-16 and 921-17, Sections 4.1-4.5

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. SCIENTIFIC METHOD OF FIRE INVESTIGATION</p> <ul style="list-style-type: none">A. Organized approach to fire investigationB. Historically, fires have been investigated in this manner<ul style="list-style-type: none">1. The term "Scientific Method" was not applied until NFPA 921C. Principle of inquiry used in science and engineeringD. Seven steps in organized approach to fire/explosion investigationE. Seven steps<ul style="list-style-type: none">1. Recognize the need2. Define the problem3. Collect data4. Analyze data5. Develop hypothesis6. Test hypothesis7. Select final hypothesisF. Inductive reasoning<ul style="list-style-type: none">1. NFPA defines inductive reasoning as "reasoning from the specific to the general"2. When we enter a fire scene, we immediately begin "maybe the fire started here or maybe here..."3. Using the three fire effects to determine the origin<ul style="list-style-type: none">a) Heatb) Depositionc) Consumption4. Thinking about the patterns and what we've observed automatically sets our minds in motionG. Deductive reasoning<ul style="list-style-type: none">1. NFPA defines deductive reasoning as reasoning from the general to the specific	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none">3) Training4) Science5) Experienceb) Subjective or speculative information cannot be included – only provable facts5. Develop hypothesis<ul style="list-style-type: none">a) Based on analysis of data origin and cause is establishedb) Solely based on empirical data collected6. Test hypothesis<ul style="list-style-type: none">a) All reasonable origins and causes need to be considered and eliminatedb) Hypothesis not provable until it can stand test of careful and serious challengec) Presumption of cause<ul style="list-style-type: none">1) Until all data is collected no presumption of cause can be formed2) All fires should be approached without presumption of caused) If hypothesis cannot withstand examination then origin and cause should be classified as undetermined7. Select final hypothesis<ul style="list-style-type: none">a) Compare hypothesis to all known factsb) Level of certainty<ul style="list-style-type: none">1) Probable<ul style="list-style-type: none">• True greater than 50%2) Possible<ul style="list-style-type: none">• Feasible, but not probable3) If two or more hypotheses are equally likely, then the level of certainty is possible	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> c) If hypothesis cannot withstand an examination by deductive reasoning it should be discarded as not provable d) Only when hypothesis can withstand examination by deductive reasoning can origin and cause be established e) Test new hypothesis with any new data and re-examination of old data <p>II. APPLICATION OF THE SCIENTIFIC METHOD TO FIRE INVESTIGATION</p> <p>A. Receiving assignment</p> <ul style="list-style-type: none"> 1. Incident notification 2. Role of the investigator <ul style="list-style-type: none"> a) Origin and cause b) Written/verbal report c) Criminal case/civil litigation d) Fire prevention e) Product liability <p>B. Preparing for an investigation</p> <ul style="list-style-type: none"> 1. Resources 2. Plan and conduct investigation 3. Tools and equipment needs 4. Initial scene investigation 5. Subsequent investigative actions <p>C. Conducting the investigation</p> <ul style="list-style-type: none"> 1. Scene investigation 2. Collect data for analysis 3. Scene documentation 4. Evidence collection 5. Interviews <ul style="list-style-type: none"> a) Other investigators b) Collect all appropriate data 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none">D. Collect/Preserve evidence<ul style="list-style-type: none">1. Recognition2. Properly collected3. Preserved4. Tested if necessary5. Properly presented in courtE. Analyzing the incident<ul style="list-style-type: none">1. Origin2. Cause3. Fire spread4. Fire patterns5. Responsibility6. Failure analysisF. Conclusions should follow scientific methodG. Reporting procedure<ul style="list-style-type: none">1. Written or oral reports generated depending in local protocol	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

The scientific method is the basis that allows a fire investigator to defend his or her opinion on what caused the fire. When the scientific method is properly employed, the fire investigator's opinion should stand on its own.

Evaluation:

The student will complete the formative and summative tests at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 4: Basic Methodology, Pages 921-16 and 921-17, Sections 4.1-4.5 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #4: Fire Development For The Investigator

Time Frame: 3:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #3: Fire Development for the Investigator

Behavioral Objective:

Condition: Given a formative and summative test

Behavior: The student will describe fire development for the investigator, including chemistry of fire, products of combustion, the oxidation process, the four states of matter, the definition of fire dynamics, the three methods of heat transfer, the different types of flame structures and phases of fire growth

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-18 through 921-39, Sections 5.1-5.12 and Chapter 18: Fire Cause Determination, Pages 921-156 through 921-157, Sections 18.3-18.3.7

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-18 through 921-39, Sections 5.1-5.12 and Chapter 18: Fire Cause Determination, Pages 921-156 through 921-157, Sections 18.3-18.3.7
- Principles of Fire Behavior, James G. Quintiere, 1997 Edition, Pages 25-45 and 49-63

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>NOTE: The students in your class are here to learn how to perform an origin and cause investigation after the fire is extinguished. It is vital for them to understand fire behavior principles from the beginning of the fire to its extinguishment in order to accurately determine the origin and the cause of the fire.</p> <p>I. FIRE BEHAVIOR</p> <p>A. Fire science</p> <ol style="list-style-type: none"> 1. That body of knowledge concerning the study of fire and related subjects and their interaction with people, structures and the environment <p>B. The fire investigator has to have a basic understanding of how a fire starts, grows, and the effects of extinguishment</p> <ol style="list-style-type: none"> 1. The science of fire plays a key role in an investigation <p>C. Fire tetrahedron</p> <ol style="list-style-type: none"> 1. Fuel 2. Heat 3. Oxygen 4. Chain reaction <p>II. FIRE CHEMISTRY</p> <p>A. Study of chemical processes that occur in fires, including changes of state, decomposition, and combustion</p> <ol style="list-style-type: none"> 1. Combustion <ol style="list-style-type: none"> a) Oxidation that generates detectable heat and light 2. Heat release rate <ol style="list-style-type: none"> a) The energy of the fire 3. Heat transfer <ol style="list-style-type: none"> a) The transport of heat energy from one point to another caused by a temperature difference between the points 	<p>How does this apply to fire investigation?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>III. PRODUCTS OF COMBUSTION</p> <ul style="list-style-type: none">A. Produced by burning<ul style="list-style-type: none">1. Heat2. Fire gases3. Solid particulates (smoke)4. Liquid aerosolsB. Complete combustion of hydrocarbon fuels with carbon and hydrogen only, yields heat, light, and carbon dioxideC. Can vary widely with<ul style="list-style-type: none">1. Ventilation2. FuelsD. Smoke is generally considered to be the collection of the solid, liquid, and gaseous products of incomplete combustionE. Combustion products<ul style="list-style-type: none">1. Solid- ash and soot2. Vapors and liquidF. CondensationG. Smoke color is not necessarily an indicator of what is burning<ul style="list-style-type: none">1. Wood can have gray to black smoke depending on ventilation2. Post flashover smoke may be black3. Synthetics may also produce large volumes of black smoke4. Fire-fighting efforts can also change color of smoke <p>IV. OXIDATION</p> <ul style="list-style-type: none">A. The process by which a substance combines with oxygen<ul style="list-style-type: none">1. Slow versus rapidB. Oxidizing agent	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>C. Normal air has 21% oxygen</p> <ol style="list-style-type: none">1. Flaming combustion 14% to 16% <p>D. Post-flashover and smoldering</p> <ol style="list-style-type: none">1. Close to 0% <p>V. FUEL</p> <p>A. Four states of matter</p> <ol style="list-style-type: none">1. Solid2. Liquid3. Aerosols and dusts4. Vapor (gas) <p>B. Pyrolysis</p> <ol style="list-style-type: none">1. The chemical decomposition of a compound into one or more other substances by heat alone2. The chemical decomposition of matter through the action of heat3. Pyrolysis often precedes combustion4. Combustion of a solid fuel takes place above the fuel surface <p>C. Flammable vapors are more easily formed from liquids than solids</p> <ol style="list-style-type: none">1. Liquids burn more rapidly than ordinary combustibles2. Vapors are being emitted at room temperature <p>D. Some synthetics melt and flow as ignitable liquids</p> <p>VI. LIQUIDS</p> <p>A. Flashpoint (of a liquid)</p> <ol style="list-style-type: none">1. The lowest temperature at which a liquid gives off vapors at a sufficient rate to support a momentary flame across its surface2. Vaporization3. Atomized or not	<p>What are the four states of matter?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>VII. VAPOR DENSITY</p> <ul style="list-style-type: none">A. The weight per unit volume of pure gas or vaporB. The ratio of the weight of a volume of vapor to the weight of an equal volume of air under the same conditions<ul style="list-style-type: none">1. Air is given the value of one<ul style="list-style-type: none">a) Vapor density less than one is lighter than air<ul style="list-style-type: none">1) Natural gas2) Propane3) Gasoline vapors2. Vapor density greater than one is heavier than air <p>VIII. FIRE DYNAMICS</p> <ul style="list-style-type: none">A. The detailed examination of chemistry, engineering disciplines of fluid mechanics, fire science, and heat transference which will interact influencing fire behavior <p>IX. HEAT</p> <ul style="list-style-type: none">A. The rate at which heat energy is generated by burning<ul style="list-style-type: none">1. The energy of the fire2. The power of the fireB. Heat release rate<ul style="list-style-type: none">1. Measured in kilowatts (kw) or megawatts (mw)2. Cotton versus polyurethane mattress<ul style="list-style-type: none">a) 40kw-970kw versus 830kw-2630kw <p>X. HEAT TRANSFER</p> <ul style="list-style-type: none">A. The transport of heat energy from one location to another<ul style="list-style-type: none">1. Caused by a temperature difference2. Also called heat fluxB. Heat transfer is a major factor in a fire and affects<ul style="list-style-type: none">1. Ignition	<p>What is the definition of "fire dynamics?"</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. Rate of fire growth 3. Fire spread to other fuel packages 4. Rate of fire decay C. Temperature vs. heat <ul style="list-style-type: none"> 1. Temperature <ul style="list-style-type: none"> a) Unit of measurement 2. Heat <ul style="list-style-type: none"> a) the energy needed to change the temperature of an object D. Heat transfer is also responsible for much of the physical evidence used by fire investigators to establish a fire's origin and thus the cause. E. Law of heat flow <ul style="list-style-type: none"> 1. The law of chemistry and physics that specifies that heat tends to flow from hot substances to cold substances 2. Heat is the energy needed to maintain or change the temperature of an object F. Thermal inertia <ul style="list-style-type: none"> 1. A measure of how easily the surface temperature of a material will increase 2. Resistance to heating 3. High thermal inertia = high resistance to heating, more energy required <ul style="list-style-type: none"> a) Wood 4. Low thermal inertia = low resistance to heating, less energy required <ul style="list-style-type: none"> a) Plastics G. Conduction <ul style="list-style-type: none"> 1. Heat transfer to another body or within a body by direct contact 2. Heat transfer within solids when one portion of the object is heated 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 3. Heat energy travels from hot to cold 4. High thermal conductivity – metals <ul style="list-style-type: none"> a) High heat flow b) Poor insulators 5. Low thermal conductivity – wood <ul style="list-style-type: none"> a) Low heat flow b) Good insulators H. Convection <ul style="list-style-type: none"> 1. Transfer of heat energy by the movement of heated liquids or gases from a source of heat to a cooler part of the environment 2. Heat transfer by circulation within a medium such as a gas or liquid 3. When air is heated, it becomes lighter and raises 4. Responsible for the greatest amount of fire spread at the early stages of the fire 5. Plays a major role in the development of the fire in the growth I. Radiation <ul style="list-style-type: none"> 1. Heat transfer by electromagnetic energy 2. Heat transfer through space and by line of sight 3. Greatest cause of heat energy transfer after the initial stages of the fire 4. Plays key role in flashover in compartment fires 5. Radiant heat transfer variables <ul style="list-style-type: none"> a) Distance between the radiator and the target b) Emissivity of the radiator <ul style="list-style-type: none"> 1) May be thought of as the “efficiency” of the radiator 2) Smoke is radiant energy <ul style="list-style-type: none"> • Higher heat transfer from dirtier or darker smoke 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> • Tar paper, styrenes, and aromatic compounds • Lower heat transfer from alcohol, ethers, and clean burning fuels <p>XI. COLOR PROPERTIES OF FLAME</p> <p>A. Color of the flame</p> <ol style="list-style-type: none"> 1. Not an accurate indicator of what is burning or the temperature of the flame <p>XII. FLAME STRUCTURE</p> <p>A. Diffusion flames</p> <ol style="list-style-type: none"> 1. Flames diffuse upward and oxygen for combustion is diffusing toward the fuel 2. Reaction takes place in the immediate vicinity of the flame 3. Oxygen and fuel will move from a high concentration to a low concentration <ol style="list-style-type: none"> a) Candle flame b) Match c) Structure fire <p>B. Premixed flames</p> <ol style="list-style-type: none"> 1. Fuel and oxidizer are mixed prior to ignition <ol style="list-style-type: none"> a) Correct air-fuel mixture required b) Oxyacetylene torch 2. Combustion explosions <ol style="list-style-type: none"> a) In a confined space <p>C. Smoldering</p> <ol style="list-style-type: none"> 1. Slow combustion process causing charring 2. Incandescent combustion with no flame 3. Self-sustained combustion <ol style="list-style-type: none"> a) Even if the heat source is removed or self-extinguished 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> b) Revert to flaming combustion when air flow is increased 4. Wood near steam pipe may only smolder when pipe is hot and may never reach ignition D. Glowing <ul style="list-style-type: none"> 1. Incandescent combustion with no flame 2. Once ignited burns to completion <ul style="list-style-type: none"> a) Coals in a barbecue E. Spontaneous heating <ul style="list-style-type: none"> 1. The release of energy by the reaction competes with the ability of the fuel to lose heat to the surrounding air 2. Self-heating <ul style="list-style-type: none"> a) Thermal runaway b) May or may not reach ignition <p>XIII.PHASES OF FIRE GROWTH</p> <ul style="list-style-type: none"> A. Ignition <ul style="list-style-type: none"> 1. The process of initiating self-sustained combustion 2. Mechanism that brings competent heat source and material first ignited together in presence of air to start fire B. Growth or incipient stage <ul style="list-style-type: none"> 1. The time period and temperature rise between ignition and fully developed phase of maximum heat production 2. Fuel load <ul style="list-style-type: none"> a) The total quantity of combustible contents b) Rate of fire growth is dependent on many factors <ul style="list-style-type: none"> 1) Fuel load 2) Fuel configuration 3) Compartment size/properties 4) Ventilation 5) Ignition source/fuel first ignited 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>3. Physical state of the fuel</p> <ul style="list-style-type: none"> a) The rate is controlled by the chemical and physical properties of a fuel b) High surface to mass ratio <ul style="list-style-type: none"> 1) Easier to ignite, less energy required <ul style="list-style-type: none"> • Sawdust, wood shavings, gases, paper c) Low surface to mass ratio <ul style="list-style-type: none"> 1) Harder to ignite, more energy required <ul style="list-style-type: none"> • Block of wood <p>C. Fully developed or free burning</p> <ul style="list-style-type: none"> 1. Fire producing maximum amount of heat 2. Flashover <ul style="list-style-type: none"> a) Convective and radiant heat from hot gas layer begins to preheat walls and ceilings as well as any combustibles high in compartment b) Hot gas layer builds in compartment due to convection c) Hot gas layer becomes deeper and hotter as fire progresses d) Transition from the first item being ignited to all of the items being ignited. <ul style="list-style-type: none"> 1) All items have reached their ignition temperature. e) If sufficient oxygen is present the fire will develop into a fuel-controlled burning process f) If there is insufficient oxygen available the fire may become a ventilation driven fire with no flaming in the hot gas layer g) As fire continues to grow, the ceiling temperatures approach 900°F increasing the intensity of radiation h) Surface of combustibles become heated, pyrolysis occurs, combustibles off gas, may reach ignition 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>i) When hot gas layer reaches between 1100-12000 f the hot gas layer ignites and radiant heat flux brings all combustibles to ignition</p> <p>3. Fuel-ventilation controlled</p> <p>a) Fuel controlled – sufficient air</p> <ol style="list-style-type: none"> 1) Fuel is limiting factor 2) A wildland fire <p>b) Ventilation controlled – sufficient fuel</p> <ol style="list-style-type: none"> 1) Oxygen is limiting factor <ul style="list-style-type: none"> • Fire inside an compartment 2) Large volumes of carbon monoxide gas <ul style="list-style-type: none"> • Incomplete combustion <p>D. Decay or smoldering</p> <ol style="list-style-type: none"> 1. Fire no longer producing maximum amount of heat 2. Fire was a smoldering/glowing fire from onset of ignition 3. No free burning <ol style="list-style-type: none"> a) Area filled with dense black smoke b) No visible flames c) Pressure buildup <ol style="list-style-type: none"> 1) Backdraft or smoke explosion d) Lack of oxygen 	<p>What is the difference between fuel and ventilation controlled fire?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

A fire investigator has to understand how a fire starts, grows, and develops because of the many different types of fuels, burning characteristics, and factors that cause a fire to increase or decrease in size.

Evaluation:

The student will complete the formative and summative tests at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-18 through 921-39, Sections 5.1-5.12 and Chapter 18: Fire Cause Determination, Pages 921-156 through 921-157, Sections 18.3-18.3.7 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #5: Legal Aspects of Fire Investigation

Time Frame: 2:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #4: Legal Aspects of Fire Investigation

Behavioral Objective:

Condition: Given an activity, formative test, and summative test

Behavior: The student will describe the legal aspects of fire investigation, including local ordinances that establish authority to investigate fire origin and cause, the current court decisions applying to the authority to hold, search, and protect a fire scene, when and what types of legally authorized searches a fire investigator may institute, and the preparation for courtroom testimony and proper demeanor

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-102 and 921-103, Sections 11.1-11.3.3.4.2, Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 21-29, and successfully completing Group Activity 5-1

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 5-1: Are You There Legally?

References:

- California Code of Civil Procedure, Sections 1822.50-1822.57
- California Fire Code, Sections 104.10 and 104.10.1
- California Health and Safety Code, Sections 13100 and 13107
- California Penal Code, Sections 1523–1542
- California Public Resources Code, Section 714
- <http://definitions.uslegal.com>
- NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-102 and 921-103, Sections 11.1-11.3.3.4.2
- Title 18: USL, Part 1, Crimes, Chapter 40, Section 844



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. CONSTITUTIONAL LAW AND THE FIRE INVESTIGATOR</p> <ul style="list-style-type: none">A. The Constitution of the United States limits the power of government and therefore, the investigatorB. The Constitution defines the rights of all citizensC. The first ten amendments to the Constitution are known as the Bill of RightsD. The investigator must understand those amendments which limit their powers and those which define the rights of the individualE. Pertinent amendments to the Constitution<ul style="list-style-type: none">1. Fourth Amendment<ul style="list-style-type: none">a) The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures shall not be violated, and no warrant shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized <p>II. SEARCH AND SEIZURE OF PROPERTY</p> <ul style="list-style-type: none">A. In 1914, the U.S. Supreme Court held that evidence obtained unlawfully could not be used against the accused<ul style="list-style-type: none">1. Applied only to persons acting under federal law2. This is the exclusionary rule that states that evidence gained unlawfully would be excluded from court3. This rule applies not only to evidence found directly by the unlawful search but also to that which flows from the excluded evidence<ul style="list-style-type: none">a) Also known as "fruit of the poisonous tree"1) A doctrine of evidence law first established in 1920	<p>What does the term "fruit of the poisonous tree" mean?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>2) Not only is evidence illegally seized inadmissible, but any evidence or testimony obtained later as a result of the illegally seized evidence is inadmissible</p> <p>B. 1961 Supreme Court rulings extended the 1914 decision to the states</p> <ol style="list-style-type: none"> 1. States must apply law at least as strictly 2. All searches are not prohibited 3. Only unreasonable or unlawful searches are prohibited <p>C. Search defined</p> <ol style="list-style-type: none"> 1. A quest by an officer of the law, and a seizure contemplates a forcible dispossession of the owner <ol style="list-style-type: none"> a) <u>Weeks v. United States</u>, 232 U.S. 383 <p>D. In relation to fire/arson investigations, "search" can be broken into two situations</p> <ol style="list-style-type: none"> 1. Fire origin and cause 2. Investigation as to the circumstances of the fire <ol style="list-style-type: none"> a) Once arson is discovered and/or the emergency has ended, the investigation must be conducted the same as any other criminal investigation b) The investigator must observe all rules of arrest, search, and seizure <p>E. The U.S. Supreme Court in 1978 laid down the minimum constitutional requirements for post fire searches in <u>Michigan v. Tyler</u>, 436 U.S. 499, 98 sct. 1842, 56 L.E.D. 2d 486</p> <p>1. Exigent/Emergency</p>	<p>Is a search warrant the only means for an investigator to enter a scene in order to investigate and collect evidence after the exigency of a scene is over?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>a) A search warrant may not be necessary when the fire department is on the premises fighting the fire, performing other fire related functions, or for a reasonable time after the fire is extinguished</p> <p>2. Consent</p> <p>a) After departure of the fire fighters and initial investigator, permission of the occupant or lawful possessor is required</p> <p>3. Abandonment</p> <p>a) Knowing relinquishment of one's right or claim to property without any future intent to gain title or possession</p> <p>F. Due to the criteria established by <u>Michigan v. Tyler</u>, the investigator, fire officer, as well as fire fighter, must know and understand the provisions of the decision</p> <p>1. No search warrant required</p> <p>a) By either fire fighting personnel or the investigator when their presence is a normal part of fire fighting activity/function and initial fire investigation</p> <p>b) When re-entry is a continuation of the first valid search and an emergency still exists</p> <p>1) Continued overhaul</p> <p>2) Prevent rekindle</p> <p>G. Consent by "lawful possessor"</p> <p>1. A return to the scene for additional examination is permissible with consent of the occupant, or person having lawful possession, after the emergency or initial investigation was terminated</p>	<p>Is a search warrant the only means for an investigator to enter a scene in order to investigate and collect evidence after the exigency of a scene is over?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>2. Consent should be in writing</p> <ul style="list-style-type: none"> a) It is recommended the investigator have such consent witnessed b) Lack of written permission may pose problems in court c) Proof of permission is on the state d) Have other fire fighters witness verbal consent e) Show of force may void permission <ul style="list-style-type: none"> 1) Must be given voluntarily f) Nonvoluntary consent <ul style="list-style-type: none"> 1) Implying guilt if consent is not given 2) Treat of arrest or detention <p>3. Who may give consent?</p> <ul style="list-style-type: none"> a) Occupant or lawful possessor of property or someone believed to be by the investigator <ul style="list-style-type: none"> 1) <u>Illinois v. Rodrigues</u>, U.S. Supreme Court b) Wives or husbands may consent to search property jointly occupied and controlled c) Parents of juveniles if <ul style="list-style-type: none"> 1) The parent claims property interest, right of possession, or right of control over the property to be searched 2) Determine whether parents have relinquished the right of control, possession, etc., of the property 3) Such things as registered ownership, age of the juvenile, etc., must be taken into consideration <p>H. Abandonment is seldom relied upon to perform and legal fire scene search</p>	<p>What would be a scenario for a nonvoluntary consent?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. Criminal search warrant</p> <ol style="list-style-type: none"> 1. Required when the following <i>do not exist</i> <ol style="list-style-type: none"> a) Consent b) Exigent circumstances c) Abandonment 2. Only issued based on probable cause <ol style="list-style-type: none"> a) Statement of fire crew <ol style="list-style-type: none"> 1) Evidence of arson <p>J. In 1984, the U.S. Supreme Court laid down additional constitutional requirements for post fire searches in <u>Michigan v. Clifford</u>, 464 U.S. 287 (1984)</p> <ol style="list-style-type: none"> 1. The court specified the use of an inspection or administrative warrant <ol style="list-style-type: none"> a) The authority to obtain an inspection warrant is found under the California Code of Civil Procedure, §1822.50 through §1822.57 <p>NOTE: Refer to <u>NFPA 921: Guide to Fire and Explosive Investigations</u>, 2008 Edition, Chapter 11: Legal Considerations, Page 921-103, Section 11.3.3.3.1 for information on administrative warrant. The California Code of Civil Procedures calls this an inspection warrant.</p> <p>III. AUTHORITY TO INVESTIGATE</p> <ol style="list-style-type: none"> A. The authority to conduct a fire investigation falls under several different codes depending on your employing agency B. Local fire and law enforcement agencies that have adopted the California Fire Code as their authority under §104.10 	<p>What is the difference between the criminal search warrant we just discussed and an inspection warrant?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>C. State Fire Marshal's Office Arson and Bomb investigators are given their authority to investigate fires under §13107 of the California Health and Safety Code</p> <p>D. California Department of Forestry and Fire Protection investigators are given their authority to investigate fires under §714(d) of the California Public Resources Code</p> <p>E. Federal agencies, such as the U.S. Forest Service, Bureau of Land Management, and Bureau of Alcohol, Tobacco, Firearms are given their authority to investigate fires under the U.S. Code Title 18, Part 1, Chapter 40</p> <p>IV. INSPECTION (ADMINISTRATIVE) WARRANT REQUIRED</p> <p>A. Inspection warrant needed when the following do not exist</p> <ol style="list-style-type: none"> 1. Consent 2. Exigent circumstances 3. Abandonment 4. No probable cause for criminal search warrant <p>B. Entry to conduct origin and cause investigation when the entry is beyond a reasonable time to conduct the search</p> <ol style="list-style-type: none"> 1. Evidence gained from inspection warrant would be admissible under the plain view doctrine 2. When criminal activity has been established a criminal search warrant is required to continue the investigation <ol style="list-style-type: none"> a) Probable cause has been established through the inspection warrant 	<p>CLASS ACTIVITY: Complete Group Activity 5-1.</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

Investigators must ascertain current changes in the law and recent court findings pertaining to arson and related cases. Each investigator should thoroughly prepare for court testimony.

Evaluation:

The student will complete the activity, formative test, and summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-102 and 921-103, Sections 11.1-11.3.3.4.2 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 21-29 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Group Activity 5-1: AM I there legally?

Time Frame: 0:30

Materials Needed:

- Legal scenarios (one for each student)
- Pen or pencil

Introduction: This activity provides the students the opportunity to use the information learned from the lesson and apply it appropriately to each scenario.

Directions:

1. Divide the class into workable groups (not more than 5 in each group).
2. Have each group read and answer each scenario.
3. They will have 15 minutes to complete this part of the activity.
4. Have the group select a spokesperson.
5. Ask one group to read the first scenario aloud, followed by their answer.
6. Check to see if other groups have any different answers.
7. Continue with the next group until all of the scenarios are read and questions answered.
8. You have 15 minutes to complete this part of the activity.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

1. At approximately 0200 hours, a fire burned the interior and exterior of a single-family dwelling. At the time of the fire, the occupants were not home. Fire suppression crews extinguished the fire and completed their suppression duties. You, the fire investigator, arrived at 0330 hours. Since it was still hot and smoky inside the residence, you decided to leave and come back when the smoke cleared. Fire suppression crews setup a fire watch. The scene was secured until your arrival at 0800 hours. You decided to conduct a fire scene investigation without consent or a warrant.

Are you there legally?
Explain your answer.

Yes, per Michigan v. Tyler

2. At approximately 0200 hours, a fire burned the interior and exterior of a single-family dwelling. At the time of the fire, the occupants were not home. Fire suppression crews extinguished the fire and completed their suppression duties. You, the fire investigator, arrived at 0330 hours. Since it was still hot and smoky inside the residence, you decided to leave and come back when the smoke cleared. The scene was secured until your arrival at 0800 hours. You decided to conduct a fire scene investigation with permission from the landlord, but not the occupants.

Are you there legally?
Explain your answer.

Yes, per Michigan v. Tyler

3. At approximately 0730 hours, a fire burned the interior and exterior of a vehicle parked in the driveway of a residence. The fire spread from the vehicle and burned a small portion of the attached garage of the residence. No one was at home at the time of the fire. Fire suppression crews extinguished the fire and left the scene. You are informed of the fire by the fire captain who was going off duty for four days. The fire captain thought the fire was arson. You arrive at the scene at approximately 1500 hours and conduct a cause and origin investigation without consent. During your investigation, you notice that the stereo is missing from the vehicle's dash. The residents are not at home.

Are you there legally?
Explain your answer.

No, you need a search warrant if you establish probable cause; if not, you need an inspection warrant

4. At approximately 0930 hours, a fire burned the interior and exterior of a three-bedroom apartment that housed three people. Fire crews extinguished the fire, completed their overhaul duties, and left the scene. Before leaving, they secured the scene with yellow barrier tape and told the three residents to keep out until the fire investigator's arrival. Due to a heavy preassigned work schedule, you do not arrive until the following morning. When you arrive on-scene, you obtain consent from two of the three residents. After searching the living room, kitchen, bathroom, and the two bedrooms (for which you received consent), you conclude that the fire started in the third bedroom. Through the opened doorway, you observe a burned charcoal lighter container lying on the carpet in the center of the room. That room's occupant is not available.

Are you there legally?
Explain your answer.

No, you need a search warrant if you establish probable cause; if not, you need an inspection warrant



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #6: Expert Testimony

Time Frame: 1:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #5: Expert Testimony

Behavioral Objective:

Condition: Given an activity, formative test, and summative test

Behavior: The student will describe the requirements of a fire investigator's expert testimony, what expert testimony means, the difference between Frye and Daubert standards, and the importance of testifying in a competent, confident manner

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire & Explosion Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-104 through 921-107, Sections 11.4-11.5.6, Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 32-49, and successfully completing Group Activity 6-1

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 6-1: Testifying with Body Language

References:

- California Evidence Code, 2009 Edition, Sections 720–723 and 800-805
- Investigation & Prosecution of Arson, California District Attorney's Association, Chapter XXIII
- NFPA 921: Guide to Fire & Explosion Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-104 through 921-107, Sections 11.4-11.5.6

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. TESTIMONY OF THE FIRE INVESTIGATOR</p> <p>A. Meet with the prosecutor as soon as possible after being notified that the case is going to trial</p> <ol style="list-style-type: none">1. Facts2. Case presentation<ol style="list-style-type: none">a) Preparation of exhibitsb) Testimony of experts and witnesses <p>B. Testimonial evidence</p> <ol style="list-style-type: none">1. Live witness speaking under oath2. Result of their investigation<ol style="list-style-type: none">a) Scene Investigationb) Interviews of witnesses3. Factual or percipient witness<ol style="list-style-type: none">a) Testimony based on observations attorney<ol style="list-style-type: none">1) A neighbor who discovered the fire and testifies about their observations4. Expert witnesses<ol style="list-style-type: none">a) Give their opinion or conclusion regarding the fire cause.b) Someone with sufficient skill, knowledge, and/or experience in a given fieldc) Have acquired expertise through experience, education, study, or a combination thereofd) Does not have to have a certain level of educatione) Must have a knowledge not found in most individuals5. The prospective expert witness can be examined by both the defense and prosecution to test the expertise of the witness<ol style="list-style-type: none">a) This process is called "voir dire"	<p>What is an expert witness?</p>



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<p>b) The defense will try to show the witness is not qualified as an expert</p> <p>1) Any past testimonies, depositions, or statements under oath</p> <p>C. Justifies the need for a well-informed and coordinated investigator or prosecutor</p> <p>1. Justifies the need for a well-informed and coordinated investigator or prosecutor team</p> <p>2. Expert witnesses are permitted to give an opinion within their field of expertise</p> <p>3. Witnesses who do not qualify as an expert usually testify to facts without stating their impressions, conclusions, or opinions.</p> <p>II. COURT STANDARDS FOR QUALIFICATION</p> <p>A. Reliability and credibility of the expert witness</p> <p>1. Basis of the expert witness's testimony</p> <p>a) Based on sufficient facts and data</p> <p>b) Product of reliable principles and methods</p> <p>1) Following accepted fire scene examination protocols</p> <p>c) Applied accepted principles and methods to the facts in the case</p> <p>B. California criminal or civil case standard</p> <p>1. Frye standard</p> <p>a) Frye v. United States, 54 App. D. C. 46, 293 F. 1013, no. 3968 "General Acceptance"</p> <p>2. Relevant to the case</p> <p>a) Assist the judge and/or jury</p> <p>1) Understand what caused the fire</p>	<p>Is there a different standard for testifying in a California court versus a federal court?</p>



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<p>3. Witness is qualified</p> <ul style="list-style-type: none"> a) Possesses the necessary qualifications to give an opinion <ul style="list-style-type: none"> 1) Education 2) Training 3) Experience 4) Skill b) Able to reach an opinion that the “average person” or “person” on the street” would not be able to <p>C. Federal criminal or civil court standard</p> <ul style="list-style-type: none"> 1. Higher standard based on the Federal Rules of Evidence <ul style="list-style-type: none"> a) Daubert v. Merrell Dow (509 U.S. 579, 113 Supreme Court 2786) "Scientific Knowledge" b) Federal Rule of Evidence 702 <ul style="list-style-type: none"> 1) Testimony based on facts/data 2) Testimony product of reliable principles and methods (peer reviewed) 3) The expert witness has applied the principles and methods to the facts in the case (deductive reasoning) c) Federal Rule of Evidence 703 <ul style="list-style-type: none"> 1) Basis of expert witness’s opinion and conclusion 2) Reasonably relied upon by other experts 2. Expert witnesses testimony <ul style="list-style-type: none"> a) Relevant to the case b) Assist the judge and/or jury <ul style="list-style-type: none"> 1) Understand what caused the fire c) Witness is qualified <ul style="list-style-type: none"> 1) Possesses the necessary qualifications to give an opinion 	



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<ul style="list-style-type: none"> 2) Education 3) Training 4) Experience 5) Skill <p>3. Reliability of opinions</p> <ul style="list-style-type: none"> a) Whether a theory or technique can be (and has been) tested b) Whether a theory or technique has been subjected to peer review and publication <ul style="list-style-type: none"> 1) Publication, or the lack thereof, is not a dispositive consideration c) The known or potential rate of error of a particular scientific technique and the existence and maintenance of standards controlling the technique's operation d) "Reliability assessment" <ul style="list-style-type: none"> 1) Does not require, although it does permit, explicit identification of a relevant scientific community 2) Expresses determination of a particular degree of acceptance of a theory or technique within that community <p>III. COURTROOM TESTIMONY AND Demeanor</p> <ul style="list-style-type: none"> A. Investigator's preparation for court <ul style="list-style-type: none"> 1. Review records, reports, and evidence 2. Always meet with the prosecutor as far in advance of the trial as possible <ul style="list-style-type: none"> a) Additional follow-up 	<p>CLASS ACTIVITY: Complete Group Activity 6-1.</p> <p>What are some ways to increase your confidence on the witness stand?</p>



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<ul style="list-style-type: none"> b) Prepare necessary courtroom exhibits c) Address any hurdles the investigator's report may present 3. Appearance <ul style="list-style-type: none"> a) Professional b) Conservative 4. Uniform versus civilian dress <ul style="list-style-type: none"> a) Class A uniform if possible b) Follow local policy and/or advice of prosecuting attorney B. Testifying <ul style="list-style-type: none"> 1. The investigator's testimony is frequently the deciding factor 2. When referring to the defendant say "defendant" 3. Practice "courtesy and patience" 4. Treat all counsel with same degree of impartiality 5. Testify with confidence gained by the complete and full knowledge of the facts of the case 6. Do not avoid answering a question <ul style="list-style-type: none"> a) Take enough time to fully understand the question b) If the question is not understood, have the question repeated c) Hesitate a moment before answering to allow for objections 7. Be alert at all times and listen attentively to all questions, remarks, or statements by counsel or court 8. An accurate statement of the fact is desired and there should be no guess work or speculation 	<p>Is it okay to "fill-in" small details to make your testimony sound more eloquent? Why or why not?</p>



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<ul style="list-style-type: none"> a) If the facts are not known, say so b) If exact times, distances, etc., are not known, qualify the statement with the word "about" or "approximately" c) If the exact words are known, use them: If not, qualify the statement with the words "In substance he said..." <ol style="list-style-type: none"> 9. Tell the truth 10. Avoid the use of slang or improper language, unless it is absolutely necessary to the evidence 11. Remember the jury is composed of lay people, so if technical language is used, follow it up by explaining it in simple terms 12. Speak clearly and loudly enough to be heard and do not hesitate to correct mistakes or errors 13. Do not give the impression that the conviction of the accused is a personal desire of the investigator 14. Do not volunteer information 15. If either attorney objects during a question, do not answer until the court has ruled on the objection and until the question has been repeated <ul style="list-style-type: none"> a) If the objection is to the investigator's answer, do not complete the answer until directed to do so by the court 16. Notes may be used to refresh the investigator's memory <ul style="list-style-type: none"> a) Permission of the court must be obtained before the notes are used b) Ask, "May I refer to my report?" 17. The object of cross examination is to test the credibility, knowledge, recollection, bias, prejudices or interest of a witness relative to his testimony on direct examination 18. Do not introduce any record of previous convictions of the defendant during your testimony 	



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Summary:

Investigators must ascertain current changes in the law and recent court findings pertaining to arson and related cases. Each investigator should thoroughly prepare for court testimony.

Evaluation:

The student will complete the activity, formative test, and summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire & Explosion Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-104 through 921-107, Sections 11.4-11.5.6 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 32-49 in order to prepare yourself for the upcoming test. Study for our next session.



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group Activity 6-1: TESTIFYING WITH BODY LANGUAGE

Time: 0:30

Materials Needed:

- Pen or pencil
- Paper

Introduction: This activity provides the students the opportunity to observe nonverbal clues that set the tone for a witness' first impression to the court and directly relates to the value placed on the testimony.

Directions:

1. Have each student write as many nonverbal communications as he or she can in two minutes.
 - Physical appearance
 - Attitude
 - Eye contact
 - Hands full of items
 - Hand positions
 - Etc.
2. Briefly discuss some of the student's responses.
3. Set-up the scene to include a judge, witness, and jury scenario.
4. Portraying the witness, enter the "courtroom" in several different ways and ask the students what your nonverbal communication suggested to the judge and jury.
 - Shy, ill-confident
 - Conceited (chest puffed, shoulders back)
 - Confident, well prepared
 - Confident, well prepared and then shuffle and fumble papers
5. Enter the witness chair in several different ways and ask the students what your nonverbal communication suggested to the judge and jury.
 - Fidgety, restless
 - Downward eyes
 - Stuttering and stammering
 - Ticks
 - Aversive language



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

Topic: #7: Arson Law

Time Frame: 1:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #6: Arson Law

Behavioral Objective:

Condition: Given an activity, formative test, and summative test

Behavior: The student will describe the state laws that establish the crime of arson, classify arson, or prove the arson investigation

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-107 and 921-108, Sections 11.5.6.1.2-11.5.6.5, Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 51-82, and successfully completing Group Activity 7-1

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 7-1: What's the Code Section

References:

- California Health and Safety Code, Sections 13000-13002, 13007
- California Penal Code, Sections 15-17, 26, 450-457.1, 654, 800-801, 11413, 12301-12303.3, 12308-12312
- California Vehicle Code, Section 23111
- NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-107 and 921-108, Sections 11.5.6.1.2-11.5.6.5

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience



FIRE INVESTIGATION 1A

Fire Cause and Origin Determination

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



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<p>NOTE: You must obtain a copy of the current applicable California code sections of arson law.</p> <p>It is important to understand that material contained within this unit of instruction may be subject to a certain amount of interpretation. Although the subject matter has been reviewed by prosecuting attorneys, it is strongly recommended that the instructor consult with the district attorney prior to delivery.</p> <p>I. RELEVANT SECTIONS OF THE CALIFORNIA PENAL CODE</p> <p>A. Section 15: Crime and Public Offense Identified</p> <ol style="list-style-type: none">1. An act committed or omitted in violation of a law2. Punishments<ol style="list-style-type: none">a) Deathb) Imprisonmentc) Fined) Removal from officee) Disqualification to hold office <p>B. Section 16: Crimes; Kinds</p> <ol style="list-style-type: none">1. Felonies2. Misdemeanors3. Infractions <p>C. Section 17: Felony and Misdemeanor</p> <ol style="list-style-type: none">1. Felony is a crime punishable with death or by imprisonment in the state prison2. Other crime or public offense is a misdemeanor<ol style="list-style-type: none">a) Unless classified as an infraction <p>D. Section 26: Persons Capable of Committing Crimes; Exceptions</p> <ol style="list-style-type: none">1. Everyone is capable of committing crimes except<ol style="list-style-type: none">a) Children under the age of 14, in the absence of clear proof that at the time of committing the act charged against them, they knew its wrongfulnessb) Persons who are mentally incapacitated	



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<p>5. <u>Maliciously</u>: imports a wish to vex, defraud, annoy, or injure another person, or intent to do a wrongful act, established either by proof or by presumption of law</p> <p>6. <u>Recklessly</u>: a person is aware of and consciously disregards a substantial and unjustifiable risk that his or her act will set fire to, burn, or cause to burn a structure, forestland, or property</p> <p style="padding-left: 40px;">a) Constitutes a gross deviation from the standard of conduct that a reasonable person would observe</p> <p style="padding-left: 40px;">b) Person is unaware because of voluntary intoxication</p> <p>C. Section 451: The Crime of Arson</p> <p>1. <u>Arson</u>: Willfully and maliciously sets fire to or burns or causes to be burned or who aids, counsels, or procures the burning of, any structure, forestland, or property</p> <p>2. Felony acts</p> <p style="padding-left: 40px;">a) 451(a) Causes great bodily injury</p> <p style="padding-left: 40px;">b) 451(b) Causes an inhabited structure or inhabited property to burn</p> <p style="padding-left: 40px;">c) 451(c) Arson of a structure or forestland</p> <p style="padding-left: 40px;">d) 451(d) Arson of property</p> <p style="padding-left: 80px;">1) Does not include personal property unless there is an intent to defraud or there is injury to another person or another person's structure, forestland, or property</p> <p>D. Section 451.1: Arson Enhancements</p> <p>1. Punishment can include a three-, four-, or five-year enhancement if one or more of the following circumstances are found to be true</p> <p style="padding-left: 40px;">a) Defendant has been previously convicted of a felony violation of Sections 451 or 452</p> <p style="padding-left: 40px;">b) A fire fighter, peace officer, or other emergency personnel suffered great bodily injury</p>	



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<p>c) Caused great bodily injury to more than one victim in any single violation of Section 451</p> <p>d) Caused multiple structures to burn in any single violation of Section 451</p> <p>e) Arson was caused by using a device designed to accelerate the fire or delay ignition</p> <p>E. Section 451.5: Aggravated Arson</p> <ol style="list-style-type: none"> 1. <u>Aggravated arson</u>: Willful, malicious, deliberate, with premeditation, and with intent to cause injury to one or more persons or to cause damage to property under circumstances likely to produce injury to one or more persons or to cause damage to one or more structures or inhabited dwellings, sets fire to, burns, or causes to be burned, or aids, counsels, or procures the burning of any residence, structure, forestland, or property if one or more of the following aggravating factors exists <ol style="list-style-type: none"> a) Defendant previously convicted of arson within the past 10 years b) Property damage and other losses in excess of \$5,650,000 c) Damaged or destroyed five or more inhabited structures 2. Imprisonment in the state prison for 10 years to life <ol style="list-style-type: none"> a) Not eligible for release on parole until 10 calendar years have elapsed <p>F. Section 452: Unlawfully/Recklessly Causing a Fire</p> <ol style="list-style-type: none"> 1. Recklessly sets fire to or burns or causes to be burned, any structure, forestland, or property 2. Felony/misdemeanor acts <ol style="list-style-type: none"> a) 452(a) Causes great bodily injury b) 452(b) Causes an inhabited structure or inhabited property to burn 	<p>Have the students cite some examples.</p>



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<p>c) 452(c) Causes a fire of a structure or forestland</p> <p>d) 452(d) Causes a fire of property is a misdemeanor</p> <p> 1) Does not include personal property unless there is injury to another person or to another person's structure, forestland, or property</p> <p>G. Section 452.1: Aggravated Unlawfully/Recklessly Causing a Fire</p> <p> 1. Shall be punished by a one-, two-, or three-year enhancement for each of the following circumstances</p> <p> a) Defendant has been previously convicted of a felony violation of Section 451 or 452</p> <p> b) A fire fighter, peace officer, or other emergency personnel suffered great bodily injury</p> <p> c) Defendant proximately caused great bodily injury to more than one victim in any single violation of Section 452</p> <p> d) Defendant proximately caused multiple structures to burn in any single violation of Section 452</p> <p>H. Section 453: Incendiary Devices</p> <p> 1. Definitions</p> <p> a) <u>Incendiary device</u>: Constructed or designed to start an incendiary fire by remote, delayed, or instant means</p> <p> 1) Example: cigarette/matchbook device</p> <p> 2) Does not include commercially manufactured devices for the purpose of illumination</p> <p>I. Section 455: Attempted Arson</p> <p> 1. <u>Attempted arson</u>: Attempts to set fire to or burn a structure, forestland or property</p> <p> a) Placing or distributing materials, substances, or devices with the intent set fire to or burn</p>	<p>What is an example of an incendiary device?</p>



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<p>b) There is no charring of the material</p> <p>J. Section 457.1: Arson Registration</p> <ol style="list-style-type: none"> 1. If convicted of arson or attempted arson, must register within 14 days <ol style="list-style-type: none"> a) Chief of police of the city b) Sheriff of the county c) Chief of police of a campus of the University of California, the California State University, or community college where the person is residing 2. Violating this requirement is a misdemeanor <p>K. Section 11413: Terrorism; Use of a Destructive Device or Explosive or Commission of Arson in Certain Places</p> <ol style="list-style-type: none"> 1. Any person who explodes or ignites (or attempts to) a destructive device or explosive, or commits arson in order to terrorize is guilty of a felony 2. Applies to the following places <ol style="list-style-type: none"> a) Health facilities or any place where medical care is provided by a licensed health care professional b) Any church, temple, synagogue, mosque, or other place of worship c) Buildings, offices, and meeting sites relating to abortion d) Any bookstore or public/private library e) Courthouse f) The home or office of a judicial officer g) County probation department h) Any private property if it was targeted because of the characteristics of the owner or occupant i) Any public or private school providing instruction in kindergarten or grades 1 to 12, inclusive 	<p>Do you have an attempted arson if some material has been charred?</p>



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<p>3. <u>Terrorizing</u>: Causes a person of ordinary emotions and sensibilities to fear for personal safety</p> <p>L. Section 12301: Destructive Device Definitions</p> <ol style="list-style-type: none"> 1. Any breakable container which contains a flammable liquid with a flashpoint of 150°F or less and has a wick or similar device capable of being ignited, other than a device which is commercially manufactured primarily for the purpose of illumination <ol style="list-style-type: none"> a) This is the CPC definition of a Molotov Cocktail 2. Any sealed device containing dry ice (CO₂) or other chemically reactive substances assembled for the purpose of causing an explosion by a chemical reaction <p>M. Section 12303.2: Possession of a Destructive Device or Explosive In or Near Certain Places</p> <ol style="list-style-type: none"> 1. Every person who recklessly or maliciously has in his possession any destructive device or any explosive on a public street or highway, in or near any theater, hall, school, college, church, hotel, other public building, or private habitation, in, on, or near any aircraft, railway passenger train, car, cable road or cable car, vessel engaged in carrying passengers for hire, or other public place ordinarily passed by human beings is guilty of a felony, and shall be punishable by imprisonment in the state prison for a period of two, four, or six years <p>N. Section 12303.3: Wrongful Possession, Explosion Etc., of a Destructive Device or Explosive with Intent to Injure or Intimidate Person or to Injure or Destroy Property</p> <ol style="list-style-type: none"> 1. Every person who possesses, explodes, ignites, or attempts to explode or ignite any destructive device or any explosive with intent to injure, intimidate, or 	<p>What constitutes terrorizing?</p> <p>Have the students cite some examples.</p> <p>Have the students cite some examples.</p>



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<p>terrify any person, or with intent to wrongfully injure or destroy any property, is guilty of a felony, and shall be punished by imprisonment in the state prison for a period of three, five, or seven years</p> <p>III. CPC FOR TIME OF COMMENCING CRIMINAL ACTIONS</p> <p>A. Regulate the statutes of limitations for an arson investigation</p> <p>B. Section 800: Offenses Punishable by Imprisonment for Eight Years or More</p> <p>1. Commenced <u>within six years</u> of the offense</p> <p>a) Section 451a: Arson that Causes Great Bodily Injury</p> <p>b) Section 451b: Arson of an Inhabited Structure</p> <p>c) Section 451.5: Aggravated Arson</p> <p>C. Section 801: Offenses Punishable by Imprisonment</p> <p>1. Commenced <u>within three years</u> of the offense</p> <p>a) Section 451c: Arson of a Structure or Forestland</p> <p>b) Section 451d: Arson of Property</p> <p>c) Section 452a: Unlawfully/Recklessly Causing a Fire that Causes Great Bodily Injury</p> <p>d) Section 452b: Unlawfully/Recklessly Causing a Fire that Causes an Inhabited Structure to Burn</p> <p>e) Section 452c: Unlawfully/Recklessly Causing a Fire of a Structure or Forestland</p> <p>f) Section 455: Attempted Arson</p> <p>IV. CALIFORNIA HEALTH AND SAFETY CODE SECTIONS</p> <p>A. Statutes concerning the negligent causing of a fire as well as discarding of cigarettes are found in the Health and Safety Code</p>	<p>What is the statute of limitations for 451a and 451b?</p> <p>What is the statute of limitation for 451c?</p>



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<p>1. These sections of the code address careless and negligent acts as compared to the reckless acts described under Penal Code Section 452</p> <p>B. Section 13000</p> <p>1. Every person is guilty of a misdemeanor who allows a fire kindled or attended by him to escape from his control or to spread to the lands of any person other than the builder of the fire without using every reasonable and proper precaution to prevent the fire from escaping</p> <p>C. Section 13001</p> <p>1. Every person is guilty of a misdemeanor who, through careless or negligent action, throws or places any lighted cigarette, cigar, ashes, or other flaming or glowing substance, or any substance or thing which may cause a fire, in any place where it may directly or indirectly start a fire, or who uses or operates a welding torch, tar pot or any other device which may cause a fire, who does not clear the inflammable material surrounding the operation or take such other reasonable precautions necessary to insure against the starting and spreading of fire</p> <p>D. Section 13002</p> <p>1. Every person is guilty of a misdemeanor who throws or discharges any lighted or nonlighted cigarette, cigar, match, or any flaming or glowing substance, or any substance or thing which may cause a fire upon any highway, including any portion of the right-of-way of any highway, upon any sidewalk, or upon any public or private property</p> <p>a) This subdivision does not restrict a private owner in the use of his or her own private property, unless the placing, depositing, or dumping of the waste matter on the property creates a public health and safety hazard, a public nuisance, or a fire hazard, as determined by a local health department, local fire department or fire district, or the Department of Forestry and Fire Protection, in which case this section applies</p>	



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<p>E. Section 13007: Liability to Owner of Property Damaged by Fire</p> <ol style="list-style-type: none"> 1. Any person who personally or through another willfully, negligently, or in violation of law, sets fire to, allows fire to be set to, or allows a fire kindled or attended by him to escape to, the property of another, whether privately or publicly owned, is liable to the owner of such property for any damages to the property caused by the fire <p>V. CALIFORNIA VEHICLE CODE SECTION RELATED TO FIRE INVESTIGATION</p> <p>A. Section 23111: Throwing Substances on Highways</p> <ol style="list-style-type: none"> 1. No person in any vehicle and no pedestrian shall throw or discharge from or upon any road or highway or adjoining area, public or private, any lighted or nonlighted cigarette, cigar, match, or any flaming or glowing substance 2. This section shall be known as the Paul Buzzo Act <p>VI. COURT CASES AND GENERAL INTENT</p> <p>A. Two court cases influence the prosecution of arson and the General Intent doctrine</p> <ol style="list-style-type: none"> 1. People v. Fry (1993) 19 Cal.App4th 1334, 24 Cal.Rptr.2d 43 <ol style="list-style-type: none"> a) Addresses the general intent component of the crime of arson and also addresses issues concerning Penal Code Section 654 regarding punishment under different provisions of the law 2. People v. Atkins (2001), Cal.4th [No S082662. Mar. 12, 2001] <ol style="list-style-type: none"> a) Addresses the general intent of the crime of arson and voluntary intoxication <p>B. Penal Code Section 654: Offenses Punishable in Different Ways by Different Provisions; Double Jeopardy; Denial of Probation</p>	<p>Is arson a general intent crime in California?</p>



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<ol style="list-style-type: none">1. An act or omission that is punishable in different ways by different provisions of law shall be punished under the provision that provides for the longest potential term of imprisonment, but in no case shall the act or omission be punished under more than one provision<ol style="list-style-type: none">a) An acquittal or conviction and sentence under any one bars a prosecution for the same act or omission under any other2. Notwithstanding subdivision (a), a defendant sentenced pursuant to subdivision (a) shall not be granted probation if any of the provisions that would otherwise apply to the defendant prohibits the granting of probation	<p>CLASS ACTIVITY: Complete Group Activity 7-1.</p>



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Summary:

A fire investigator must have current knowledge of applicable laws involving fires and explosions. During an investigation, an investigator has to be sure that all the elements of a crime, such as arson, be addressed.

Evaluation:

The student will complete the activity, formative test, and summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 11: Legal Considerations, Pages 921-107 and 921-108, Sections 11.5.6.1.2-11.5.6.5 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 51-82 in order to prepare yourself for the upcoming test. Study for our next session.



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GROUP ACTIVITY 7-1: WHAT'S THE CODE SECTION?

Time Frame: 0:15

Materials Needed:

- Arson law scenarios (one for each student)
- Pen or pencil

Introduction: This activity provides the students the opportunity to apply the appropriate arson or fire related laws.

Directions:

1. Divide the class into workable groups (not more than 5 in each group).
2. Have each group read and answer each scenario.
3. They will have 5 minutes to complete this part of the activity.
4. Have the group select a spokesperson.
5. Ask one group to read the first scenario aloud, followed by their answer.
6. Check to see if other groups have any different answers.
7. Continue with the next group until all of the scenarios are read and questions answered.
8. You have 10 minutes to complete this part of the activity.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

1. Fire fighters arrive to find a fully-involved interior of an older model vehicle in the backyard of Mr. Barns' residence. Fire has gutted the interior of vehicle and has extended from the vehicle to include charring of the neighbor's wooden fence. A check of the registered owner shows that Mr. Barns owns the vehicle outright, has no insurance coverage, and the vehicle has a nonoperative status. He's been issued a correction notice to get rid of the debris accumulated on his property, including this old vehicle. Mr. Barns claims he does not know how the fire started, although he smells of gasoline and has singeing to his eyebrows and the hair on his head and hands.

What CPC section(s) would best describe this scenario?

451(d)

2. As an investigator, you are called out to a business where the owner has found the rear door of his business broken and in an open position. Inside, he has found three 1-gallon containers of gasoline with wadded newspaper strung between the containers.

What CPC section(s) would best describe this scenario?

459/455

3. As an investigator, you are called out to a business where the owner has found the rear door of his business broken and in an open position. Inside, he has found three 1-gallon containers of gasoline with wadded newspaper near the rear door that shows signs of charring and burning itself out.

What CPC section(s) would best describe this scenario?

459/451c

4. You have responded to a vegetation fire where the area of origin is located adjacent to a newly installed wrought iron fence. A welder states that he was welding on a fence panel when he noticed the field next to him was on fire.

What CPC section(s) would best describe this scenario?

13001

5. A traffic stop has been made on a vehicle in a wildland high hazard area known to be frequented by would-be arsonists. A search of the vehicle has turned up several "cigarette-match" time-delay devices.

What CPC section(s) would best describe this scenario?

453(a)



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #8: Fire Scene Documentation

Time Frame: 1:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #7: Fire Scene Documentation

Behavioral Objective:

Condition: Given an activity, formative test, and summative test

Behavior: The student will describe the basics of documenting a fire scene, and the relevant information within the scene and preserve it

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 11: Legal Considerations, Page 921-106, Section 11.5.2.2, Chapter 15: Documentation of the Investigation, Pages 921-121 through 921-134, Sections 15.1-15.5.3 and Annex A, Pages 921-259 through 921-273 and successfully completing the Individual Activity 8-1

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 8-1: Scene Sketching

References:

- NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 11: Legal Considerations, Page 921-106, Section 11.5.2.2, Chapter 15: Documentation of the Investigation, Pages 921-121 through 921-134, Sections 15.1-15.5.3 and Annex A, Pages 921-259 through 921-273

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)

Curiosity (arouse)

Interest (create)

Desire (stimulate)

Begin

Association

Students

Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. DOCUMENTATION REQUIREMENTS</p> <ul style="list-style-type: none">A. Fire scene narrativeB. Witness statementsC. EvidenceD. PhotographsE. DiagramF. Notes<ul style="list-style-type: none">1. Discoverable2. Retention<ul style="list-style-type: none">a) Written policyb) Consistently kept or discardedc) Anything used to document the sceneG. Purpose<ul style="list-style-type: none">1. Record location and relationship of evidence and surroundings2. Refresh memory3. Provide permanent record of conditions4. Assist in understanding the scene <p>II. FIRE SCENE NARRATIVE</p> <ul style="list-style-type: none">A. Occurrence<ul style="list-style-type: none">1. Date2. Day3. Time4. Weather<ul style="list-style-type: none">a) Temperatureb) Wind speedc) Wind directiond) Humidity (if known)B. Location of fire<ul style="list-style-type: none">1. Address or other identifier	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> C. Description of fire <ul style="list-style-type: none"> 1. Vehicle 2. Structure 3. Wildland D. Exterior <ul style="list-style-type: none"> 1. Fire patterns 2. Physical evidence <ul style="list-style-type: none"> a) Forcible entry b) Trailers c) Containers E. Fire flow patterns through scene <ul style="list-style-type: none"> 1. Smoke 2. Heat 3. Char 4. Melting F. Area of origin <ul style="list-style-type: none"> 1. Evidence supporting conclusion 2. Indicators supporting conclusion G. Ignition scenario H. Cause <ul style="list-style-type: none"> 1. Evidence that supports conclusion I. Witness statements <ul style="list-style-type: none"> 1. Written narrative of statements J. Evidence <ul style="list-style-type: none"> 1. Evidence described and storage K. Photographs <ul style="list-style-type: none"> 1. List of photographs taken of scene <p>III. DIAGRAM</p> <ul style="list-style-type: none"> A. Sketching definition (NFPA 921, Section 15.4.1.1) 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none">1. Generally freehand diagrams drawn with minimal tools<ul style="list-style-type: none">a) Completed at the sceneb) Can be 2- or 3-dimensionalc) Not to scaleB. Diagramming definition (NFPA 921, Section 15.4.1.2)<ul style="list-style-type: none">1. Generally more formal2. Completed after the investigation3. Can be traditional methodology or computer generatedC. One court's definition<ul style="list-style-type: none">1. "A diagram is simply an illustrative outline of a tract of land, or something else capable of linear projection, which is not necessarily intended to be perfectly correct or accurate"D. General considerations<ul style="list-style-type: none">1. Combine features of notes and photographs2. Provide a broader view of scene, topography3. Not a substitute for notes or photographs4. Diagram limits<ul style="list-style-type: none">a) Decide what to include and what to eliminateb) Choose fixed points for outdoor references5. Procedure<ul style="list-style-type: none">a) Rough outlineb) Develop a base linec) Overall view of scened) Measurements<ul style="list-style-type: none">1) Accurate within reason2) Measured versus estimates3) All measurements are approximate	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none">4) Long distances can be measured with an odometer<ul style="list-style-type: none">• Example: 1/4 or 1/2 mile5) Scale of the diagram may be listed as "Not To Scale"6. Format<ul style="list-style-type: none">a) Use standard symbolsb) Lettered or numbered squares and circlesc) Place north towards the top of the paged) Show direction that doors open using a curved linee) Include wind direction at time of firef) Title<ul style="list-style-type: none">1) Incident number2) Location, address3) Date of incident4) Date of diagram7. Signature of person drawing diagram	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

The accuracy and completeness of the documentation often is reflected in the outcome of a trial. The specific locations of evidence can become a major point of disagreement at trial months or years after the incident. Careful documentation can refresh the investigator's memory as well as substantiate the investigator's testimony at trial.

Evaluation:

The student will complete the activity, formative test, and summative test at a time determined by the instructor.

Assignment:

Review your notes and NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 11: Legal Considerations, Page 921-106, Section 11.5.2.2, Chapter 15: Documentation of the Investigation, Pages 921-121 through 921-134, Sections 15.1-15.5.3 and Annex A, Pages 921-259 through 921-273 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Individual Activity 8-1: Scene Sketching

Time Frame: 0:30

- Materials Needed:**
- Evidence item such as an aluminum can or plastic bottles
 - Book of matches
 - Clipboard or notebook
 - Paper
 - Pen or pencil

Introduction: This activity provides the students the opportunity to demonstrate the accurate skills of documenting evidence by completing a sketch.

- Directions:**
1. You will be assigned an item of evidence.
 2. Diagram the item and the room it is located.
 3. Accurately document its location in relation to other items within the room.
 4. The following information must be included within the diagram:
 - a. Location
 - b. Diagram date
 - c. Signature
 - d. Measurements
 - e. Room and furniture location
 5. You have 15 minutes to complete this diagram.
 6. Be prepared to discuss your diagram with the class or submit to the instructor for grading.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #9: Point Of Origin Determination

Time Frame: 4:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #8: Point of Origin Determination

Behavioral Objective:

Condition: Given an activity, formative test, and summative test

Behavior: The student will describe the relationship between point of origin and fire cause; the term "overhaul" and explain why overhaul must sometimes be delayed; the indicators and techniques used to identify point of origin; and the importance of scene reconstruction

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosion Investigations, NFPA, 2008 Edition, Chapter 6: Fire Patterns, Pages 921-39 through 921-59, Sections 6.1-6.4.1.2 and Chapter 17: Origin Determinations, Pages 921-144 through 921-155, Sections 17.1-17.8.3 and successfully completing Group Activity 9-1

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 9-1: Burn Pattern Indicators (Option 1 or 2)

References:

- NFPA 921: Guide to Fire and Explosion Investigations, NFPA, 2008 Edition, Chapter 6: Fire Patterns, Pages 921-39 through 921-59, Sections 6.1-6.4.1.2 and Chapter 17: Origin Determinations, Pages 921-144 through 921-155

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

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Curiosity (arouse)
Interest (create)
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Begin
Association
Students
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Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>1. Normal versus abnormal fire spread characteristics</p> <ol style="list-style-type: none"> a) Fire spread b) Fire intensity <p>G. Investigators need to show caution when identifying an obvious ignition source; then building the point of origin to justify the ignition source</p> <p>II. OVERHAUL DEFINED</p> <p>A. The operation of looking for a hidden flame or spark that might rekindle the fire</p> <ol style="list-style-type: none"> 1. Overhaul operations must be delayed whenever practical <p>B. Overhaul may result in the following actions which could hinder the investigator and/or investigation</p> <ol style="list-style-type: none"> 1. Removal of both damaged and undamaged contents 2. The unnecessary "pulling" or "opening" of walls and ceilings 3. Destruction of indicators necessary to determine point of origin and fire cause 4. Destruction of evidence 5. Loss of flammable accelerant residue and/or vapor <p>C. Fire companies should remain at the fire scene until the investigator has completed the scene examination</p> <ol style="list-style-type: none"> 1. To complete and/or assist with overhaul operations 2. To extinguish hidden fires <p>III. SCENE EXAMINATION PROCEDURE FOR POINT OF ORIGIN IDENTIFICATION</p> <p>A. Develop and adhere to a well organized and coordinated investigative procedure</p> <ol style="list-style-type: none"> 1. Do not develop preconceived conclusions, especially based on unsupported statements of others 	<p>How could overhaul hinder the investigator?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ol style="list-style-type: none"> 2. Be objective, keep an open mind, and evaluate all the evidence before reaching even tentative conclusions 3. Be alert to "red flags" which suggest inconsistencies 4. Remember an indicator is just that --- one indicator alone is not conclusive <p>B. <u>First</u> examine the <u>exterior</u> of the structure</p> <ol style="list-style-type: none"> 1. Note areas damaged by heat and smoke only <ol style="list-style-type: none"> a) Smoke stains <ol style="list-style-type: none"> 1) Around doors 2) Around windows 3) Around vents 4) Under eaves b) Smoke stains on windows <ol style="list-style-type: none"> 1) Smoke staining can suggest areas remote from point of origin <ul style="list-style-type: none"> • Caution must be used 2. Next, note areas of exterior fire damage 3. Observe the farthest extension of the fire <ol style="list-style-type: none"> 4. Use a systematic procedure of moving from least to most damaged areas to determine the area of origin <ol style="list-style-type: none"> a) Area of origin often found nearby, however, the venting of the fire through doors/windows can alter normal paths of fire travel as well as indicators b) Note any plume generated patterns on exterior of building <ol style="list-style-type: none"> 1) Plume generated patterns "V" pattern may include remaining structural elements which burn away in cone shape 2) May require standing away from structure 	<p>Why would you first look for heat/smoke damage rather than fire damage?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>5. Note utility connections as well as overall structure and surrounding area condition</p> <p>C. Interior structure examination</p> <ol style="list-style-type: none"> 1. The investigator must usually work backwards in relation to the fire's travel or spread <ol style="list-style-type: none"> a) Examine areas of least damage and work toward areas of most severe damage <ol style="list-style-type: none"> 1) Light to heavy smoke 2) Light to heavy heat 3) Light to heavy char 2. Ceiling damage may help locate the point of origin <ol style="list-style-type: none"> a) Area above point of origin usually exposed to heat and flame for longer periods and may result in holes in the ceiling <ol style="list-style-type: none"> 1) Confirm damage was not caused by overhaul operations 2) Confirm damage was not due to hose streams 3) Identify structural damage above ceiling 4) Identify fuel load below ceiling damage <p>IV. PLUMES AND PLUME DEVELOPMENT</p> <ol style="list-style-type: none"> A. Confined fires generally follow a similar growth process B. Ignition <ol style="list-style-type: none"> 1. Competent ignition source <ol style="list-style-type: none"> a) Sufficient temperature b) Sufficient energy c) Sufficient duration d) Ability to transmit energy to target fuel and bring fuel to ignition 2. Early fire growth/plume development 	<p>What other reasons or cause are there for ceiling damage?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 3. Smoke filling 4. Smoke escaping/venting 5. Approach to flashover 6. Flashover/post-flashover C. All fire pattern analysis tied to plumes and plume development <ul style="list-style-type: none"> 1. Plumes <ul style="list-style-type: none"> a) Heat from the fire rises through convection b) Cool air at base and along plume column (entrainment) c) Decreased temperatures with height of plume due to entrainment 2. Entrainment <ul style="list-style-type: none"> a) The process of air or gases being drawn into a fire, plume, or jet 3. Decreased temperatures of plume also result from convection and radiation as well as venting and entrainment 4. Unconfined fires <ul style="list-style-type: none"> a) Heat and smoke rise vertically until cool to ambient temperature b) Smoke will stratify and disperse 5. Confined fires <ul style="list-style-type: none"> a) Low heat release fires and fires remote from combustible surfaces will behave like unconfined fires 6. Fires confined by a ceiling <ul style="list-style-type: none"> a) Hot gases and smoke impinge on ceiling b) Plume moves horizontally c) Ceiling jet forms <ul style="list-style-type: none"> 1) Thin layer of hot products of combustion under the ceiling 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none">d) Heat is convected to ceiling and any nearby combustibles by the ceiling jete) Ceiling jet is hottest near the plume's centerlinef) Ignition of combustible wall or ceiling material, or other combustibles high in compartmentg) Gases in upper smoke layer may transfer heat by convection and radiation to nearby combustiblesh) Transfer of heat below smoke column is dominated by radiationi) Fire growth when plume is confined by ceiling will be faster than when plume is unconfined <p>D. Effects of plume development on fuel location</p> <ul style="list-style-type: none">1. In the center of the compartment2. Along a wall3. In a corner <p>E. Plume development on the center of the compartment</p> <ul style="list-style-type: none">1. Entrainment 360°2. Little or no radiant heat feedback <p>F. Plume development along a wall</p> <ul style="list-style-type: none">1. Entrainment 180°2. Radiant heat feedback 90° <p>G. Plume development in a corner</p> <ul style="list-style-type: none">1. Entrainment 90°2. Radiant heat feedback 180° <p>H. Plume development phases</p> <ul style="list-style-type: none">1. Triangular phase2. Columnar phase3. Conical phase <p>I. Plume generated patterns may help to identify point of origin</p>	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>J. Truncated cone patterns created by the flame plume will be found on walls, ceiling, or bottoms of tables and shelves</p> <p>K. Once ceiling damage has been identified</p> <p>V. WALL PATTERNS</p> <p>A. History of the fire</p> <ol style="list-style-type: none"> 1. Plume development 2. Ventilation 3. Pattern development <p>B. Surface affects</p> <ol style="list-style-type: none"> 1. Nature, shape, texture, and material of surface containing pattern will affect <ol style="list-style-type: none"> a) Shape and nature of pattern b) Shape of lines of demarcation 2. Smooth versus rough surfaces of same material <ol style="list-style-type: none"> a) Rougher surface will sustain more damage due to turbulence and surface to mass ratio <p>C. Plume generated patterns</p> <ol style="list-style-type: none"> 1. ANY burning material will produce a column of rising heat, called a plume 2. Rising heat will leave a fire pattern if it comes into contact with another material 3. Truncated cone patterns <ol style="list-style-type: none"> a) Plume intersects with planar surface <ol style="list-style-type: none"> 1) Wall 2) Ceiling 3) Furniture b) Lines of demarcation are created between heat damaged areas and areas of less damage <ol style="list-style-type: none"> 1) "V" patterns 2) Inverted cone 3) Hourglass 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 4) Pointer and arrow 5) Circular 4. Rising hot gases above a burning item form a cone with its apex directed down toward the source of heat 5. Near the source of the heat the sides diverge to form a cone describing the boundary of the flame zone <ul style="list-style-type: none"> a) As hot gases rise they cool and spread outward b) Entrainment brings fresh air into base 6. Physical barriers contribute to lateral extension 7. Hot gas "V" often upright 8. Flame zone "V" may be inverted 9. Pattern may be hourglass 10. Plume width at base <ul style="list-style-type: none"> a) Narrow pattern small surface area b) Wide pattern wide surface area 11. Airflow at base may affect both base width and angle demarcation lines D. Combustible surfaces <ul style="list-style-type: none"> 1. Lateral spread often widens pattern base 2. Flame spread issues 3. Pattern geometry affected by burning surface E. "V" shaped patterns <ul style="list-style-type: none"> 1. Flames 2. Convected heat 3. Smoke 4. Fire plume and less heated areas (patterns within patterns) 5. Angle of "V" patterns <ul style="list-style-type: none"> a) Heat release rate b) Ventilation c) Ignitibility of exposed surfaces 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> d) Horizontal surfaces e) Does <u>not</u> indicate speed of fire growth <ul style="list-style-type: none"> 1) Wide "V" does <u>NOT</u> indicate a slowly growing fire 2) Angle of borders of "V" pattern does <u>NOT</u> indicate speed of fire growth 3) Narrow "V" does <u>NOT</u> indicate a rapidly growing fire F. Inverted cones <ul style="list-style-type: none"> 1. Flame plumes may not reach ceiling 2. Indicator of short lived fire 3. Do not fully evolve into floor-to-ceiling plumes 4. Often appear on surfaces that are noncombustible 5. Fire does not always spread to nearby combustibles 6. Correct analysis burning was of relatively short duration rather than any relationship to the rate of heat release 7. Not proof of ignitable liquid fires based on pattern analysis alone 8. Any fuel source can produce inverted cone patterns provided pattern not restricted by a horizontal surface G. Hourglass <ul style="list-style-type: none"> 1. Composed of hot gas zone shaped like a "V" and flame zone at its base 2. Flame zone shaped like an inverted "V" 3. When hot gas zone is truncated by vertical plane "V" pattern is formed 4. When fire is close to vertical surface the pattern will show the effects of hot gas zone and the flame zone as large "V" above an inverted "V" 5. The inverted "V" is generally smaller and may exhibit more intense burning or clean burn 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>H. Truncated cone patterns</p> <ol style="list-style-type: none"> 1. Three dimensional fire patterns displayed on horizontal and vertical surfaces 2. Cone shaped dispersion of heat is caused by natural expansion of the plume as it rises 3. Plume spreads horizontally when there is obstruction to vertical movement – such as ceiling 4. Thermal damage to ceiling will generally extend beyond circular area attributed to cone <ol style="list-style-type: none"> a) "V" will usually point toward the origin of the pattern, which may also be the fire's origin <p>I. "V" pattern not at the point of origin</p> <ol style="list-style-type: none"> 1. The shape of the fire pattern is effected by the heat release rate of the fuel, creating a variety of patterns from columnar to hourglass depending on time and temperature 2. The angle of the plume generated pattern is dependent on several variables <ol style="list-style-type: none"> a) The plume width varies with the size of the base of the fire and will increase over time as the fire spreads b) A narrow base pattern will develop from a small surface area fire, and a wide base pattern will develop from a fire with a large surface area c) The heat release rate and geometry of the fuel d) The effects of ventilation e) The ignitability of the vertical surface on which the pattern appears f) Combustibility of the vertical surface on which pattern appears g) The presence of interceding horizontal surfaces h) The angle of the borders of the plume generated pattern does not indicate speed of fire growth 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> i) Inverted cone patterns indicate a fire of short duration that did not develop into floor to ceiling plumes rather than any relationship to the rate of heat release 3. Plume generated pattern may only be identifiable from a distance in large structure fires 4. Plume generated pattern may extend around corners, doors, walls, and only one side of the "V" may be distinguishable 5. Interior structural elements may form cone shaped pattern J. Lowest level of burning as an indicator of point of origin <ul style="list-style-type: none"> 1. Normal fire travel is upward and outward 2. Burning in a downward direction is usually much slower than upward 3. The point of origin is generally located at or very near the lowest level of burning a) Establishes times when various fuels/materials heated burned and fell to the floor b) Determine if debris is normal for given occupancy or area c) If detailed examination is anticipated, retain debris for later sifting 4. Examine underside of contents for fire damage <ul style="list-style-type: none"> a) Fire damage to underside of contents may indicate point of origin at lower level b) Contents to examine <ul style="list-style-type: none"> 1) Chairs 2) Sofa 3) Tables 4) Ironing boards 	<p>What is the necessity for removing debris in layers?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>5. Examine underside of structural elements for fire damage</p> <ul style="list-style-type: none"> a) Shelves b) Window sills c) Doors <p>VI. FLOOR PATTERNS</p> <p>A. Carpeting and rugs</p> <ul style="list-style-type: none"> 1. Resistant to ignition or fire spread since 1970 2. ASTM Standard D2859 3. Typically resistant to ignition from small heat sources 4. Surface covering made of polypropylene however can support combustion with a relatively limited open flame source such as a small amount of burning paper 5. Prior to flashover, fire will not normally spread across a room on the surface of ASTM standard carpets without external help <p>B. Flashover and floor covering</p> <ul style="list-style-type: none"> 1. Carpet is expected to ignite when exposed to flashover 2. Radiant heat flux exceeds ignition temperature 3. Radiant heat flux also damages upper surfaces of contents as well as floor covering 4. If fire does not progress to full room involvement damage may be surface charring, blistering, melting 5. Protected surfaces may show no damage 6. High radiative flux and radiation from descending hot gas layer can create extensive burn patterns at floor level 7. Holes can be burned through carpet and floors 8. Damage increases with time 9. Extreme conditions of full room involvement can produce major damage in a few minutes depending on ventilation and fuels present 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>10. Where fire has transitioned through flashover to fully developed phase, burning to floor level is not necessarily indicative of an origin at floor level</p> <p>C. Lines/Areas of demarcation</p> <ol style="list-style-type: none"> 1. Borders defining the differences in certain heat and smoke effects of the fire on various materials 2. Are affected by <ol style="list-style-type: none"> a) The material b) Heat release rate c) Fire suppression d) Temperature e) Ventilation f) Time of heat exposure <p>D. Drop down (fall down)</p> <ol style="list-style-type: none"> 1. Burning material falling 2. Fall down can ignite other combustible materials that may be confused with area of fire origin <p>E. Pattern shape</p> <ol style="list-style-type: none"> 1. Circular patterns <ol style="list-style-type: none"> a) Represent areas that have been protected from burning by circular items 2. Irregular, curved, pool shaped <ol style="list-style-type: none"> a) Should <u>NOT</u> be identified as resulting from ignitable liquids on basis of shape alone b) In cases of full room involvement, patterns similar in appearance to ignitable liquids can be produced when no ignitable liquid is present c) Limited overall damage <ol style="list-style-type: none"> 1) Small irregular patterns may indicate presence of ignitable liquids, use of supporting evidence still recommended 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2) When overall damage is limited – radiant heating may cause pattern formation that can be misinterpreted as ignitable liquid burn patterns d) Pooled ignitable liquids that soak into flooring or floor covering as well as melted plastic can produce irregular patterns e) Patterns can also be produced by localized heating or fallen fire debris 3. Doughnut <ul style="list-style-type: none"> a) Roughly ring-shaped burn pattern surrounds less burned area, may result from ignitable liquid b) Patterns should be examined for supporting evidence of ignitable liquids rather than relying on pattern geometry alone C) Liquids versus melted solids (plastics) <ul style="list-style-type: none"> 1) Many solids will liquefy and when they burn on the floor produce irregularly shaped or circular patterns 2) Irregularly shaped or circular patterns when found in unexpected places may be erroneously identified as ignitable liquid patterns and associated with an incendiary fire cause 3) The investigator should be careful to identify properly the initial fuel source for any irregularly shaped or circular patterns F. Saddle burns <ul style="list-style-type: none"> 1. Distinctive "U" or saddle shaped patterns that are sometimes found on the top edges of floor joists 2. Caused by fire burning downward through the floor above the affected joist G. Trailers <ul style="list-style-type: none"> 1. Fire patterns that are found along floors to connect separate fires 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. Move fires from one level within a structure to another 3. Fuels may be ignitable liquids, solids or combinations 4. When floor is cleared patterns of extensive heat damage with undamaged or less damaged areas along sides may be observed 5. Presence of furniture, stock, counters, or storage may be responsible for wide straight patterns on floors 6. Patterns from wear, irregularly shaped objects on floor, may produce patterns that may be inaccurately interpreted as trailers <p>H. Large area patterns</p> <ul style="list-style-type: none"> 1. Fuels widely dispersed before ignition 2. Fire movement is very rapid such as flash fire 3. Flashover <p>I. Low damage</p> <ul style="list-style-type: none"> 1. Burning between seams or cracks in floorboards, around door thresholds, sills, baseboards may or may not indicate presence of ignitable liquids 2. If ignitable liquids are suspected, samples should be collected and laboratory tests should be used to verify their presence 3. Burning of floors, around thresholds, sills, baseboards due to <ul style="list-style-type: none"> a) Radiation b) Hot fire gases c) Ventilation <p>J. Holes in horizontal surfaces caused by</p> <ul style="list-style-type: none"> 1. Ignitable liquids 2. Glowing embers 3. Effects of flashover 4. Full room involvement 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 5. Surface below a liquid remains cool until liquid is consumed <ul style="list-style-type: none"> a) Holes may result when ignitable liquid has soaked into floor or accumulated below floor level b) Evidence other than shape and size of holes are necessary to confirm the cause of a given pattern 6. When doors are closed on a fire hot gases venting through openings can damage both the upper and lower edges of the door as well as the threshold K. Penetration of horizontal surfaces <ul style="list-style-type: none"> 1. Radiant heat 2. Direct flame impingement 3. Localized smoldering 4. Effects of ventilation 5. To identify the direction of the burn the investigator MUST examine the sloping sides of the hole L. Spalling <ul style="list-style-type: none"> 1. Breakdown of tensile strength of concrete or masonry products caused by exposure to high temperatures and rates of heating 2. Caused by <ul style="list-style-type: none"> a) Heat b) Freezing c) Chemicals d) Abrasion 3. Induced more readily in poorly finished or formulated surfaces 4. Spalling often linked to unusually high temperatures caused by ignitable liquids 5. In the past, spalling at fire scene has been thought to be a positive indicator of a liquid accelerant involved fire 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>6. Primary mechanism of spalling is expansion or contraction of surface while rest of mass expands or contracts at different rates</p> <p>7. Common cause is cooling by water during extinguishment</p> <p>8. The presence or absence of spalling in and of itself should not be construed as an indicator of the presence or absence of ignitable liquid accelerants</p> <p>a) The presence of ignitable liquids will <u>NOT</u> normally cause spalling beneath the surface of the liquid</p> <p>b) Importance of spalling to investigator lies in analysis and documentation of the heat source responsible for the fire</p> <p>VII. POINTER AND ARROW PATTERNS</p> <p>A. Displayed on series of combustible elements such as studs and furring strips</p> <p>B. Progress of fire can be traced back by examination and comparison of damage and shapes</p> <p>C. Generally shorter and more severely burned studs will be closer to source of fire</p> <p>D. Heights of remaining studs increase as distance from source of fire increases differences in height and severity of charring</p> <p>E. Shape of studs' cross section will tend to produce "arrows" pointing back in general direction of source of heat</p> <p>F. Burning off the sharp angles of the edges toward the heat source</p> <p>G. Edges have more surface to mass ratio and often burn more severely than areas of greater mass</p> <p>H. More severe charring can be expected on the side of the stud closest to heat source</p>	<p>CLASS ACTIVITY: Complete Group Activity 9-1 (Option 1 or 2).</p>



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>VIII.CHARRING AND CHAR DEPTH ANALYSIS</p> <ul style="list-style-type: none">A. Materials decompose as a result of heat and flame<ul style="list-style-type: none">1. Paint2. Wall covering3. Synthetics (plastics)4. Paper and woodB. Nature, shape, texture and material of the surface containing the pattern<ul style="list-style-type: none">1. Affect shape and nature of the pattern2. Affect the actual shape of the lines of demarcation3. If both a smooth and rough surface of the same material are exposed to the same source of heat, the rougher surface will sustain more damage4. Turbulence of the hot gases interacting with the surface as well as an increase in the surface-to-mass ratioC. Synthetic fuels<ul style="list-style-type: none">1. Char patterns have changed as fuels and fire behavior in compartments have changed due to proliferation of2. Alternative causal factors must be factored in prior to accepting the hypotheses that any specific char pattern indicator is positive proof of anythingD. Ventilation<ul style="list-style-type: none">1. Ventilation of fires and hot gases through windows, doors, or other openings in a structure greatly increases the velocity of the flow over combustible materials2. More heat is transferred by convection as the velocity of the hot gasses increaseE. Wood pyrolysis<ul style="list-style-type: none">1. Charred wood is likely to be found in nearly all structural fires	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. When exposed to elevated temperatures: wood undergoes chemical decomposition that drives off water vapor, volatile gases, and various pyrolysis products as smoke 3. The solid residue that remains is primarily carbon 4. Char shrinks as it forms, and develops cracks and blisters <p>F. Rate of charring and burning of wood</p> <ul style="list-style-type: none"> 1. In general has no relation to its age once the wood has been dried 2. The use of char appearance to make determinations about fuels involved in a fire should be done with careful consideration of all the possible variables that can affect the speed and severity of burning 3. Evaluate fire spread, rather than for the establishment of specific burn times or intensity of heat from adjacent burning materials 4. Which combustible components were exposed the longest to a heat source 5. Relative depth of char from one area to another is the key to appropriate use of charring 6. Locating the places where the damage was more severe due to exposure, ventilation, or fuel placement, from those with less severe damage 7. The investigator may then deduce the direction of fire spread, with decreasing char depths being farther away from the heat source <p>G. Variables</p> <ul style="list-style-type: none"> 1. Affect the validity of depth of char analysis <ul style="list-style-type: none"> a) Depth of char measurements may be useful in determining more than one fire or heat source b) Comparison of char depth should be done only with identical materials at identical heights c) Wood can exhibit deeper charring when adjacent to a ventilation source or an opening where hot fire gases can escape 	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> d) Each comparable depth of char measurement should be made with the same tool and same technique e) Factor in fire dynamics, fuel load, ventilation in understanding variables in char depth and appearance H. Consistency in the method of measuring the depth of char is the key to accurate figures <ul style="list-style-type: none"> 1. Blunt-ended probes, such as certain types of calipers, tire tread depth gauges, or specifically modified metal rulers can be used 2. The same measuring tool should be used for any set of comparable measurements 3. Nearly equal pressure for each measurement while inserting the measuring device is also necessary for accurate results I. Char depth measurements should be made at the center of char blisters, rather than in or near the crevasses between blisters <ul style="list-style-type: none"> 1. When determining the depth of charring, the investigator should take into consideration any burned wood that may have been completely destroyed by the fire and add that missing depth of wood to the overall depth measurement J. The investigator is cautioned that no specific time of burning can be determined based solely on depth of char <ul style="list-style-type: none"> 1. The depth of char measurements should not be relied on to determine the duration of the burning 2. The rule of 1" (2.54 cm) in 45 minutes for the rate of charring of pine is based on one set of laboratory conditions in a test furnace 3. Fires may burn with more or less intensity during the course of an uncontrolled fire than under a controlled laboratory fire 4. Charring rate is also a function of the velocity of hot gases and the ventilation conditions 	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>5. Fast-moving gases or ventilation can lead to rapid charring</p> <p>K. The appearance of the char and cracks has been given meaning by the fire investigation community beyond what has been substantiated by controlled experimentation</p> <ol style="list-style-type: none"> 1. It has been widely stated that the presence of large shiny blisters (alligator char) is proof that a liquid accelerant was present during the fire 2. This is a misconception 3. These types of blisters can be found in many different types of fires 4. There is no justification that the appearance of large, curved blisters is an exclusive indicator of an accelerated fire <p>L. It is sometimes claimed that the surface appearance of the char, such as dullness, shininess, or colors, has some relation to the use of a hydrocarbon accelerant or the rate of fire growth</p> <ol style="list-style-type: none"> 1. There is no scientific evidence of such a correlation, and the investigator is advised not to claim indications of accelerant or fire growth rate on the basis of the appearance of the char alone <ol style="list-style-type: none"> a) Glass objects as an indicator used to help locate point of origin, but can be extremely variable <ol style="list-style-type: none"> 1) Type and thickness of glass 2) Rate of heating 3) Degree of insulation created by glazing 4) Degree of restraint provided by frame 5) Flame contact early or late in fire 6) How and when glass was cooled b) Effects of these products of combustion vary with <ol style="list-style-type: none"> 1) Heat buildup 2) Intensity of fire 	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 3) Speed of fire spread 4) Distance from the fire c) Smoke production varies with <ul style="list-style-type: none"> 1) Type of material burned 2) Rate of burning 3) Duration of burning d) Smoke stain and glass <ul style="list-style-type: none"> 1) Accumulates on cold/cool surfaces 2) Stops forming when temperatures reach approximately 700°F 3) Glass fragments that have no products of combustion can indicate failure prior to the fire, failure very early in the fire, or direct flame contact 4) The degree of staining of glass is dependent on type of fuel, flame contact, ventilation, type of fire smoldering or free burning e) Heavy smoke stain may indicate <ul style="list-style-type: none"> 1) Smoldering combustion 2) Incomplete combustion 3) Combustion of synthetic based fuels such as foams and plastic found in today's fire f) Light smoke stain may indicate <ul style="list-style-type: none"> 1) Little fire damage 2) Rapid heat buildup 3) Close to point of origin 4) Farthest from point of origin g) Crazing of glass <ul style="list-style-type: none"> 1) Crazing can be found near the point of origin 	<p>What is the significance of smoke staining to the investigator?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2) Crazed glass must be evaluated with respect to other crazed glass found in the structure 3) This term is applied to a series of short cracks that develop in the glass 4) These cracks may or may not extend through the thickness of the glass 5) Laboratory experimentation has shown that the most likely cause is rapid cooling during suppression, rather than any indication of rapid heating h) Heat fracturing of glass <ul style="list-style-type: none"> 1) Smooth undulating cracks that develop along the edges of the glass where it sits in the frame 2) These cracks may or may not cause collapse of the glass 3) These cracks have been shown in laboratory test to be a result of the temperature variation between the center of the pane and the edges of the glass protected by the frame and or glazing i) Surface pits <ul style="list-style-type: none"> 1) Half-moon shapes found on surface of glass 2) Usually results from water being applied to heated glass 3) Generally indicates glass was in frame when fire streams were used 4) Can resemble crazing j) Glass objects to be examined <ul style="list-style-type: none"> 1) Windows 2) Mirrors 3) Light bulbs 4) Table tops 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>k) Broken glass due to mechanical force</p> <ol style="list-style-type: none"> 1) Requires careful examination 2) Check glass for <ul style="list-style-type: none"> • Concentric fractures • Radial fractures 3) Can indicate forced entry prior to fire or explosion <ul style="list-style-type: none"> • Look for clean or dirty edges 4) May produce protected glass 5) Pie-shaped pieces 6) Conchoidal fracture lines on edges compared to smooth edges broken by heat <p>l) Light bulbs as an indicator of point of origin</p> <ol style="list-style-type: none"> 1) Bulbs may begin to swell or distort when exposed to heat 2) May show the direction of fire travel <p>2. Heat and flame vector diagrams</p> <ol style="list-style-type: none"> a) The investigator can diagram "arrows or pointers" to indicate the fire's travel through the building based on all identified burn pattern indicators b) "Arrow" location based on information obtained as per burn pattern evaluation (char depths, beveling, etc.) c) The "arrows" will assist you to locate the area of origin d) Use caution when evaluating e) Consider all variables <p>IX. VENTILATION</p> <ol style="list-style-type: none"> A. Ventilation controlled fires can produce large volumes of carbon monoxide gas B. Incomplete combustion 	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ol style="list-style-type: none"> 1. Smoke is a collection of <ol style="list-style-type: none"> a) Solid b) Liquid c) Gaseous products C. Smoke patterns can be used to help determine origin and spread of fire D. Smoke color is not necessarily an indicator of what is burning <ol style="list-style-type: none"> 1. Wood gray to black depending on ventilation 2. Post flashover smoke may be black 3. Synthetics may also produce large volumes of black smoke 4. Fire-fighting efforts can also change color of smoke 5. Smoke production rates are generally less in the early phase of a fire but increase greatly with the onset of flashover E. Ventilation <ol style="list-style-type: none"> 1. When fire has sufficient air for complete combustion the fire behavior is fuel driven 2. When fire has insufficient air for complete combustion the fire behavior is ventilation driven F. Ventilation patterns <ol style="list-style-type: none"> 1. More heat is transferred by convection as the velocity of the hot gases increases 2. Ventilation of fires and hot gases through windows, doors, or other openings in a structure greatly increase the velocity of the flow over combustible materials 3. Well vented fires burn with a higher heat release rate 4. Higher heat release rate combined with higher radiation temperatures can burn wood at a higher rate, spall concrete, or deform metal 5. Areas of great damage are result of <ol style="list-style-type: none"> a) High heat release rate 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>b) Ventilation effects</p> <p>c) Long exposure to fire</p> <p>d) <u>NOT ALWAYS AREA OF ORIGIN</u></p> <p>e) Ventilation generated patterns</p> <ol style="list-style-type: none"> 1) Blowing air over embers will raise their temperature and may affect fire travel and produce unnatural burning 2) Causes of drafts <ul style="list-style-type: none"> • Natural building ventilation • Forced ventilation 3) Identify drafts and evaluate indicator accordingly <p>f) Fire-fighting operations and the point of origin</p> <ol style="list-style-type: none"> 1) Can alter normal fire travel 2) Question fire officers and crews to determine placement 3) Evaluate fire scene while considering effects of hose streams/ventilation <p>g) Melting and heat damage as an indicator to help locate point of origin</p> <ol style="list-style-type: none"> 1) Heat damage usually most severe close to the area of origin 2) Melting of objects may be used to trace the fire's travel <ul style="list-style-type: none"> • Telephones • Electrical wall plates 	<p>How can fire-fighting operations affect fire travel?</p> <p>Why should melted objects not be overlooked by investigators?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 3) Heat usually accumulates at upper areas of room or structure 4) Lower heat damage, with respect to total situation, may indicate area or point of origin h) Lack of specific point of origin <ul style="list-style-type: none"> 1) Extensive floor damage and depth of char may only identify the area of origin 2) May indicate that the fire started over a large area at the same time 3) May indicate presence of accelerant i) Change of fuel load can cause false indicator 6. Reconstruction to determine point of origin <ul style="list-style-type: none"> a) Most fire scenes should be reconstructed by placing as much of the building's contents back in their original position <ul style="list-style-type: none"> 1) Fire travel 2) To locate fire cause 3) To locate fire cause b) Reconstruction usually allows the investigator to check or follow fire damage to lowest level c) Reconstruction frequently aids in locating "V" pattern on contents d) Contents usually leave evidence of their former position in the form of a clean, unburned area known as a "protected area(s)" <ul style="list-style-type: none"> 1) Aid in later inventory of area 2) May aid in discovery of arsonist's motive e) Structural components should also be reconstructed <ul style="list-style-type: none"> 1) Replace doors 2) Replace boards, panels, etc. 	<p>How is reconstruction performed?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>f) Burned contents and structural components are often removed prior to the arrival of the investigator and must be replaced accurately</p> <ol style="list-style-type: none">1) Contents must be replaced exactly as they were prior to being moved by fire fighters2) Contents that were removed from the structure then brought back in and turned 180° from their original positions, could produce inconsistencies thus making the point of origin more difficult to determine3) Burn patterns found on such items can serve as important indicators as to fire travel4) Special care should be taken during replacement so as not to alter indicators5) Owner, occupant, fire fighters, or neighbors can assist with accurate replacing of items moved during extinguishment operations	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

The fire investigation process is an imprecise science of "reading" burn pattern indicators. The fire scene investigator needs to be aware of the changing aspect of fire and how every item is affected.

The most important requirement of the investigator is to be able to correctly interpret each indicator in light of the total fire picture. Investigators cannot use a single indicator or build total reliability on any given indicator. There is no "always" in burn pattern indicators.

Evaluation:

The student will complete the activity, formative test, and summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosion Investigations, NFPA, 2008 Edition, Chapter 6: Fire Patterns, Pages 921-39 through 921-59, Sections 6.1-6.4.1.2 and Chapter 17: Origin Determinations, Pages 921-144 through 921-155 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

group Activity 9-1: burn pattern indicators (option 1)

Time: 0:30

Materials Needed:

- Computer
- Projector
- Screen
- Laser pointer
- Conference pad
- Marking pens

Introduction: This activity provides the students the opportunity to determine the fire's point of origin by identifying burn pattern indicators for direction of fire travel.

Directions:

1. Divide the class into teams.
2. Have the teams select a scribe and a spokesperson.
3. Display the first scenario slide and ask the teams to look for indicators of fire progression.
4. The scribe will write their team's list of indicators onto a conference pad for that slide.
5. The spokesperson will present their team's list to the class.
6. Proceed through each slide using the steps above.
7. The last slide in the scenario will identify the point of origin.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

group Activity 9-1: burn pattern indicators (option 2)

Time: 0:30

Materials Needed:

- Copies of six fire scene scenario photographs (one set per team)
- Conference pad
- Marking pens

Introduction: This activity provides the students the opportunity to determine the fire's point of origin by identifying burn pattern indicators for direction of fire travel.

Directions:

1. Divide the class into teams.
2. Have the teams select a scribe and a spokesperson.
3. Distribute the first scenario photograph and ask the teams to look for indicators of fire progression.
4. The scribe will write their team's list of indicators onto a conference pad for that photo.
5. The spokesperson will present their team's list to the class.
6. Proceed through each photograph using the steps above.
7. The last photo in the scenario will identify the point of origin.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #10: Ignition

Time Frame: 1:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #9: Ignition

Behavioral Objective:

Condition: Given a formative and summative test

Behavior: The student will describe ignition, including the three components needed for ignition, the four step heat source competency test for ignition, the difference between generation, transmission, and heating, the comparison of the different classifications of ignition, the process of self-heating ignition, and solid fuel flaming ignition

Standard: With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-26 through 921-32, Sections 5.7-5.7.4.3 and Chapter 18: Fire Cause Determination, Pages 921-156 through 921-158, Sections 18.3-18.5.3

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Ignition Handbook, Vytenis Babrauskus, Fire Science Publishers, 2003 Edition
- Kirk's Fire Investigation, John DeHaan, Pearson Prentice Hall, 2006, Sixth Edition
- NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-26 through 921-32, Sections 5.7-5.7.4.3 and Chapter 18: Fire Cause Determination, Pages 921-156 through 921-158, Sections 18.3-18.5.3

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. IGNITION</p> <p>A. The definition of ignition</p> <ol style="list-style-type: none">1. Initiation of self sustained combustion2. To catch fire with or without the application of an external heat source <p>a) "To start the fire"</p> <p>B. During a fire investigation, the investigator has to</p> <ol style="list-style-type: none">1. Determine the area of origin2. Determine the material first ignited3. Identify the heat source4. How the heat source and fuel first ignited came together <p>C. The fire investigator has to determine the mechanism of ignition</p> <ol style="list-style-type: none">1. Consider all combustibles at area of origin<ol style="list-style-type: none">a) Which of the available fuels at origin was the one that was first ignited2. Which fuels and ignition sources can be matched that will lead to ignition<ol style="list-style-type: none">a) At the area of origin, which available ignition sources are <u>unable</u> to cause ignition3. You prove what caused the fire by<ol style="list-style-type: none">a) Determining the area of originb) Determining the material first ignitedc) Identifying the heat source	<p>What is the simple definition of "ignition?"</p> <p>What does an investigator need to do during an investigation?</p> <p>How do you prove what ignited the fire?</p>



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>d) How the heat source and fuel first ignited came together</p> <p>4. You prove what didn't cause the fire by</p> <ol style="list-style-type: none"> a) Determining the origin b) Determining the material first ignited c) Identifying <u>all</u> the potential heat sources d) Being able to explain how any of the other heat sources <u>were not</u> responsible for igniting the material first involved <p>5. <u>PROVING</u> what didn't start the fire is as critical as what did</p> <ol style="list-style-type: none"> a) Becomes the cornerstone of the investigation b) This is a critical component of the incendiary fire <p>II. IGNITION EVENT</p> <p>A. Three components for ignition</p> <ol style="list-style-type: none"> 1. Material first ignited 2. Heat source 3. Event/process that brings the two together <p>B. Fuel</p> <ol style="list-style-type: none"> 1. Four states of matter (fuel) <ol style="list-style-type: none"> a) Vapor b) Liquid c) Aerosols and dusts d) Solid <p>C. Heat sources</p> <ol style="list-style-type: none"> 1. Forms of heat energy <ol style="list-style-type: none"> a) Chemical b) Electrical c) Mechanical d) Nuclear 	<p>How do you prove what didn't ignite the fire?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>D. Four step heat source competency test for ignition</p> <ol style="list-style-type: none">1. Does the heat source have sufficient temperature?<ol style="list-style-type: none">a) Temperature is an arbitrary measurement of heat<ol style="list-style-type: none">1) Fahrenheit scale2) Celsius or Centigrade scale2. Does the heat source have sufficient heat energy?<ol style="list-style-type: none">a) Heat energy is the "power" of the fireb) Heat energy of a substance is its heat release rate<ol style="list-style-type: none">1) Measured in watts<ul style="list-style-type: none">• Cotton versus polyurethane mattress• 40 kw to 970 kw versus 830 kw to 2630 kw3. Was the heat source there for a sufficient duration?4. Was the heat source able to transmit heat to target fuel? <p>III. IGNITION PROCESS</p> <p>A. Three components</p> <ol style="list-style-type: none">1. Generation<ol style="list-style-type: none">a) Sufficient heat energy<ol style="list-style-type: none">1) Capable of transmitting energy to the fuel and to raise fuel to ignition2. Transmission<ol style="list-style-type: none">a) Sufficient energy to raise fuel to ignition<ol style="list-style-type: none">1) Direct contact2) Conduction3) Direct flame contactb) If there is separation between fuel and heat source requires energy to bring fuel to ignition<ol style="list-style-type: none">1) Convection2) Radiation	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>3. Heating</p> <p>a) Heat generation</p> <ol style="list-style-type: none"> 1) Type and amount of energy reaching fuel <ul style="list-style-type: none"> • Fuels react differently to heat energy contact <p>b) Thermal inertia</p> <ol style="list-style-type: none"> 1) The properties of a material that characterize its rate of surface temperature rise when exposed to heat 2) Mechanical inertia <ul style="list-style-type: none"> • The higher the inertia the harder to move • The higher the thermal inertia the harder the fuel is to ignite 3) Increasingly more heat has to be applied <ul style="list-style-type: none"> • Longer duration of heat exposure before ignition <p>B. Forms and mechanisms of ignition vary</p> <ol style="list-style-type: none"> 1. Form of the material <ol style="list-style-type: none"> a) Gas b) Liquid c) Solid 2. The chemical properties of the material 3. The form and intensity of heating <p>C. Classifications of ignition</p> <ol style="list-style-type: none"> 1. Smoldering <ol style="list-style-type: none"> a) Solid phase combustion <ol style="list-style-type: none"> 1) Thermal decomposition or pyrolysis creates char 2) Oxidative pyrolysis is thermal decomposition involving oxygen 	<p>What is the definition of thermal inertia?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>B. Flammable range</p> <ol style="list-style-type: none"> 1. Fuel air ratio that supports burning of the vapors 2. Too lean versus too rich an air-fuel mixture <ol style="list-style-type: none"> a) Gasoline: 1.4 to 7.6 <p>C. Atomized liquids or mists</p> <ol style="list-style-type: none"> 1. More easily ignited due to high surface to mass ratio 2. Piloted ignition can occur at temperatures below the published flash point of the bulk liquid when in the form of a spray <p>V. SELF HEATING/IGNITION</p> <p>A. Process where a material undergoes a chemical reaction and increases in temperature solely due to exothermic reaction (heat producing) between the solid and air</p> <ol style="list-style-type: none"> 1. Most organic materials and metals capable of reacting with oxygen will oxidize at some critical temperature with the evolution of heat 2. Generally self-heating to self-ignition in organic materials of animal and vegetable polyunsaturated fatty acids <ol style="list-style-type: none"> a) Such fatty acids react with oxygen to produce heat <ol style="list-style-type: none"> 1) Fatty acids <ul style="list-style-type: none"> • Animal fats • Cooking oil (peanut) • Drying oils in cellulosic material (wood, cloth, paper) • Linseed oil 2) Oxidation of carbonaceous material <ul style="list-style-type: none"> • Coal • Large quantity of charcoal 	<p>What are some examples of material that can self-heat or ignite?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 3) Biologically induced oxidation <ul style="list-style-type: none"> • Moist hay stacks • Biomass and compost piles 4) Heat-induced oxidation of cellulosic material <ul style="list-style-type: none"> • Wood fiber • Cloth 5) Polymerization reactions <ul style="list-style-type: none"> • Plastic • Adhesive b) Consumer amounts of motor or lubricating oils are NOT expected to self-heat to ignition 3. Spontaneous ignition requires <ul style="list-style-type: none"> a) Material must be capable of self-heating b) Heating to thermal runaway c) Heat generated exceeds heat losses d) Heating must result in smoldering e) Heat buildup generally greatest in most insulated parts of fuel package f) Self-heating to ignition requires material to be <ul style="list-style-type: none"> 1) Porous 2) Permeable 3) Oxidizable 4) When smoldering fuel must char without melting g) Tendency to self-heat is package dependent <ul style="list-style-type: none"> 1) Size 2) Shape 3) Surroundings h) Initial temperature may be the most important factor in ignition i) Without oxygen, oxidation and heat generation are inhibited unless oxidizer is in the fuel 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>j) Minimum temperature for ignition from self-heating is generally less than minimum ignition temperature</p> <p>VI. WOOD IGNITION FROM SELF-HEATING</p> <p>A. Wood is subject to self-heating when exposed to elevated temperatures below ignition temperature</p> <p>B. The initial heat application is an endothermic reaction</p> <p>C. Long-term low heating factors</p> <ol style="list-style-type: none"> 1. Nature of heating 2. Size 3. Geometry 4. Area exposed to heat 5. Depth of char <p>D. Short-term heating</p> <ol style="list-style-type: none"> 1. Less than one day 2. Minimum temperature for ignition approximately 482°F <p>E. Heat source must be below ignition temperature of the wood to start char formation, eventually the wood may began to smolder starting char formation</p> <p>F. Wood pyrolysis products are capable of reacting with oxygen and will oxidize at some critical temperature with the evolution of heat</p> <p>G. A process where the wood undergoes a chemical reaction and increases in temperature solely due to an exothermic reaction between the solid and the air</p> <p>H. Wood may go through oxidative pyrolysis however external heating is required to start char process</p> <p>I. Self-heating becomes increasingly more important as char develops and oxidative pyrolysis occurs in the crevasses between the char blisters</p> <p>J. Precise self-heating to ignition temperatures have not been established by scientific testing with long term heating of wood</p>	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>VII. SOLID FUEL FLAMING IGNITION</p> <ul style="list-style-type: none">A. Two forms of solid fuel flaming ignition<ul style="list-style-type: none">1. Piloted flaming ignition2. Flaming autoignitionB. Smoldering can transition to flaming ignition if sufficient vapors are produced<ul style="list-style-type: none">1. Often created by airflow across the smolder regionC. When vapor production is sufficient for flaming, char may act as the ignition sourceD. Time to flaming from smoldering is not predictable<ul style="list-style-type: none">1. Governed by airflow across the regionE. When flaming combustion is initiated by smoldering the appearance of first flame may be slow<ul style="list-style-type: none">1. Fire development often more rapid due to preheatingF. Solid fuel piloted ignition<ul style="list-style-type: none">1. Melted/vaporized2. Pyrolysis<ul style="list-style-type: none">a) Vapor production from heat application3. Vapors ignited by a pilot source<ul style="list-style-type: none">a) Flameb) Sparkc) Emberd) Hot surfaceG. Solid fuel piloted ignition factors<ul style="list-style-type: none">1. Ignition temperature variables2. Heat flux3. Thermal inertiaH. Solid fuel autoignition factors<ul style="list-style-type: none">1. Highly dependent on environmental factors<ul style="list-style-type: none">a) Heatingb) Airflow	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

Fire investigators must have sufficient expertise to testify not only to the origin of the fire, but the ignition sequence of the material first ignited. Fire investigators must follow the methodology of ignition described in NFPA 921.

Evaluation:

The student will complete the formative and summative tests at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-26 through 921-32, Sections 5.7-5.7.4.3 and Chapter 18: Fire Cause Determination, Pages 921-156 through 921-158, Sections 18.3-18.5.3 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

- Topic:** #11: Accidental Ignition Sources
- Time Frame:** 3:00
- Level of Instruction:** Level II
- Authority:** 2009 Fire Investigator CTS #10: Accidental Ignition Sources
- Behavioral Objective:**
- Condition:** Given a formative and summative test
 - Behavior:** The student will describe accidental ignition sources, including the elements required for a fire cause; the common accidental fire causes; and the indicators which help identify accidental fire causes
 - Standard:** With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire & Explosion Investigations, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-26 through 921-32, Sections 5.7-5.7.4.3; Chapter 18: Fire Cause Determination, Pages 921-155 and 921-156, Sections 18.1-18.1.4; Chapter 19: Analyzing the Incident for Cause and Responsibility, Pages 921-158 and 921-159, Sections 19.1-19.2.1.4; Chapter 24: Appliances, Pages 921-199 through 921-208, Sections 24.1-24.6.15; and Chapter 26: Wildfire Investigations, Page 921-232, Section 26.7.2.3
- Materials Needed:**
- Conference board/pads with markers/erasers
 - Appropriate audiovisual training aids and devices
- References:**
- Ignition Handbook, Vytenis Babrauskas PhD, 2003 Edition, Page 930
 - Kirk's Fire Investigation, John DeHaan, Sixth Edition, Pages 174-175
 - NFPA 921: Guide to Fire & Explosion Investigations, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-26 through 921-32, Sections 5.7-5.7.4.3; Chapter 18: Fire Cause Determination, Pages 921-155 and 921-156, Sections 18.1-18.1.4; Chapter 19: Analyzing the Incident for Cause and Responsibility, Pages 921-158 and 921-159, Sections 19.1-19.2.1.4; Chapter 24: Appliances, Pages 921-199 through 921-208, Sections 24.1-24.6.15; and Chapter 26: Wildfire Investigations, Page 921-232, Section 26.7.2.3



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> b) The terms "arson" and "incendiary" are used as synonymous terms to indicate a fire purposely started when the individual starting the fire knows it is wrong 2. Fires that are not arson but can result in criminal prosecution <ul style="list-style-type: none"> a) Reckless b) Negligent D. Undetermined <ul style="list-style-type: none"> 1. Whenever the cause cannot be proven to an acceptable level of certainty 2. A fire that has insufficient evidence <ul style="list-style-type: none"> a) Cause classification can be changed with the addition of new information E. The following terms are misused to describe the fire cause <ul style="list-style-type: none"> 1. Suspicious or unknown <p>III. OWNER'S/OCCUPANT'S BEHAVIOR</p> <ul style="list-style-type: none"> A. May not be honest about accidental fire B. Reasons for evasion <ul style="list-style-type: none"> 1. Belief that the insurance company will not pay claim if they failed to prevent the fire 2. Shame or embarrassment <ul style="list-style-type: none"> a) Particularly with child set fires 3. Cost of fire extinguishment 4. To protect others from blame/prosecution C. Misrepresentation/evasion could initiate a criminal investigation of an otherwise accidental occurrence <ul style="list-style-type: none"> 1. Because of inconsistency 2. How to handle this type of situation <ul style="list-style-type: none"> a) Take the honest approach; don't be overbearing b) Allow individuals to explain 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>IV. PUBLIC INVESTIGATOR'S ROLE AT AN ACCIDENTAL FIRE</p> <ul style="list-style-type: none">A. Remain objectiveB. Identify the point of originC. Establish ignition scenarioD. Document cause<ul style="list-style-type: none">1. Do not collect any evidence related to an accidental fire cause2. Use photographs and diagrams <p>V. CHECKPOINTS FOR AN ACCIDENTAL FIRE</p> <ul style="list-style-type: none">A. Heating equipment<ul style="list-style-type: none">1. Coal, wood, or solid fuel heating systems2. Oil burning equipment3. Gas burning equipment4. Portable electrical heating equipment5. Stationary electrical heating equipment6. Chimney or flue fires7. Electric blankets8. Heating elementsB. Cooking equipment<ul style="list-style-type: none">1. Coffeemakers<ul style="list-style-type: none">a) Failure of thermal cut-off devices (TCOs)2. Toasters<ul style="list-style-type: none">a) Food caught in heating elements3. Refrigerators<ul style="list-style-type: none">a) Blocked air vents4. Dishwashers<ul style="list-style-type: none">a) Items contacting the heating element	<p>What is the role of the public fire investigator at an accidental fire scene?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 5. Microwave ovens <ul style="list-style-type: none"> a) Improper items being cooked b) Used to evaporate ignitable liquids 6. Autoignition of cooking oils <ul style="list-style-type: none"> a) Add water to cooking fires C. Careless smoking <ul style="list-style-type: none"> 1. Often over-used as fire cause by fire personnel 2. If suspected fire cause is due to careless smoking <ul style="list-style-type: none"> a) Do/were occupants smoking? b) Were smokers in or have access to the area before the fire? c) Evidence of smoking materials 3. Heat generated by a smoldering cigarette <ul style="list-style-type: none"> a) Burning at rest 930°F-1300°F b) Burning during puffing 1520°F-1670°F 4. 3.5w heat release rate <ul style="list-style-type: none"> a) Relatively high temperature low energy heat source 5. Depending on such factors as brand and freshness, cigarettes can smolder for as long as 30 minutes 6. Cigarettes in contact with most combustibles usually result in localized charring and then extinguish 7. Cigarettes, smoldering ignition sources and the ignition of combustibles <ul style="list-style-type: none"> a) Dense cellulosic furniture fabric insulates the fire b) A cigarette falling between the sofa back and cushion can produce the required insulation c) Cigarettes in contact with cotton (cellulosic) material can result in smoldering, then open flame combustion 	<p>What type of fire is caused by a discarded cigarette?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> d) The cigarette must be in contact with a material capable of supporting smoldering/glowing ignition e) 1973 - Required that any mattress sold in the United States be resistant to ignition from cigarette <p>8. Time required before open flaming combustion varies</p> <ul style="list-style-type: none"> a) Type of material coming into contact with the cigarette b) Physical arrangement of the piece of furniture <p>NOTE: According to <u>Ignition Handbook</u>, page 930, the mean time for transition from smoldering to flaming ignition in upholstered furniture is 88 minutes with the range of 22 to 306 minutes.</p> <ul style="list-style-type: none"> c) Under ideal laboratory conditions open flaming combustion can occur in as little as 20 minutes or as long as 3 hours <p>9. Indicators of fires resulting from a smoldering ignition source</p> <ul style="list-style-type: none"> a) Smoldering fires inside padded furniture may produce temperatures from 1400°F to 1600°F causing collapse of the springs b) Smoldering furniture fires can produce large quantities of heavy smoke and soot for a considerable time prior to open flame c) Check for heavy smoke staining on windows/mirrors in area at or near point or origin d) Check with occupants about the smell of smoke prior to the fire e) Check for smoke detector activation f) Heavy/Localized floor damage charring may result from a piece of smoldering furniture g) Penetration and collapse of combustible floor 	<p>At what temperature can furniture springs collapse?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>10. Fires resulting in building collapse or extensive building damage may produce sufficient heat to</p> <ul style="list-style-type: none">a) Collapse springsb) Cause total destruction <p>11. Foamed plastics, latex foam rubber (butadiene/styrene rubbers) and/or polyurethane foam furniture padding and smoldering ignition sources</p> <ul style="list-style-type: none">a) Latex foam rubber can support smoldering combustionb) Certain synthetic products are designed with fire safety in mind and are <u>resistive to low ignition sources</u> and ignition is not likelyc) Polyurethane foam<ul style="list-style-type: none">1) Resistive to smoldering ignition sources2) Requires additional ignition source3) Burning of bedding material is required before this material becomes a significant fire problem - susceptible to open flamed) Polyvinyl chloride (PVC) fabrics<ul style="list-style-type: none">1) Commonly used as mattress covers2) Will not support smoldering ignition3) Self extinguishing4) Will burn under forced flame conditione) Once ignited, these materials can produce<ul style="list-style-type: none">1) Extreme heat2) Large volumes of heavy, black smoke3) Very rapid burning4) Very deep char patterns5) Deep red flame color6) Can mislead investigator due to exhibiting characteristics similar to those produced when a liquid accelerant is used	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. Clothes dryer <ul style="list-style-type: none"> a) Build up of lint b) Failure of the temperature/moisture sensor c) Malfunction of the thermostat F. Personal equipment <ul style="list-style-type: none"> 1. Curling iron <ul style="list-style-type: none"> a) Failure of the thermal cutoff device b) Failure of the connection between the cord and the curling iron <ul style="list-style-type: none"> 1) Repetitive rotation in one direction G. Lighting <ul style="list-style-type: none"> 1. Incandescent <ul style="list-style-type: none"> a) Bulb contact with combustibles b) Usually greater than 50 watts 2. Compact fluorescent <ul style="list-style-type: none"> a) Have been known to cause a fire when used inappropriately <ul style="list-style-type: none"> 1) Dimmer switch 3. Fluorescent <ul style="list-style-type: none"> a) Ballast <ul style="list-style-type: none"> 1) No thermal protection 2) Internal flammable potting compound b) Transformer 4. Quartz halogen <ul style="list-style-type: none"> a) Brief contact with combustible will result in a fire b) Over 1100°F H. Ignitable liquids <ul style="list-style-type: none"> 1. Improper storage area 2. Can occur in almost any occupancy 3. Area function not compatible with safe ignitable liquid storage (any quantity) 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 4. Ignitable liquid vapors not protected against potential ignition sources 5. Check for code compliance <ul style="list-style-type: none"> a) Can occur either inside or outside of the structure 6. Improper selection and use of storage containers <ul style="list-style-type: none"> a) Nonapproved light-weight plastic containers b) Nonapproved light-weight metal containers c) May rust or deteriorate along seams d) Slow leaks may develop 7. Improper use of ignitable liquids <ul style="list-style-type: none"> a) Ignitable liquids often improperly used as cleaning fluid <ul style="list-style-type: none"> 1) Gasoline 2) Kerosene 3) Alcohol 4) Lighter fluid 8. May be spread over large floor area <ul style="list-style-type: none"> a) Cleaning equipment usually found at or near area of origin b) Occupants will usually confirm findings 9. Ignitable liquids and ignition sources <ul style="list-style-type: none"> a) Ignitable liquid vapors usually settle to lowest level in the involved area b) May contact ignition source and flash back over large area c) Ignitable liquid vapors, such as gasoline, given the proper circumstances can explode with the force equivalent to high explosives 	<p>Does anyone know of an incident where gasoline was used as a cleaning solvent and resulted in a fire?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> d) Can result in severe structural damage e) Usually accompanied by fire f) Indicators of the presence of ignitable liquids in accidental fires <ul style="list-style-type: none"> 1) Rapid flame spread 2) Heavy charring developed from short time exposure to heat I. Open flames and sparks <ul style="list-style-type: none"> 1. Welding and cutting 2. Friction and sparks from machinery 3. Thawing pipes and soldering with open flames 4. Candles J. Lightning <ul style="list-style-type: none"> 1. Evidence of physical damage not always present 2. May produce unnatural burn patterns <ul style="list-style-type: none"> a) Fulgurites possibly present due to electrical energy striking the earth <ul style="list-style-type: none"> 1) Power lines can also cause fulgurites 3. Confirm weather in area at and prior to fire K. Other accidental fire causes <ul style="list-style-type: none"> 1. Sunlight <ul style="list-style-type: none"> a) Rays can be concentrated to produce ignition temperature of common combustible materials b) Many articles/items have been involved in this type of fire <ul style="list-style-type: none"> 1) Fish bowl 2) Shaving or make up mirrors (concave) 3) Concave bottom of shiny aerosol can 4) Magnifying glass 5) Eye glasses 6) Clear bottle with clear liquid 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none">c) Reconstruction of scene may help identify such fire causes2. Accidental chemical spills<ul style="list-style-type: none">a) Oxidizers in contact with reducing agents may produce heat/fireb) Contamination of chemicals may produce sufficient heat to cause auto-ignition or ignition of nearby combustiblesc) Accidental chemical spills resulting in fire/explosion in illegal labs3. Overdriven electrical staples4. Mosquito repellent candles	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

Establishing an accurate fire cause is one of the primary responsibilities of a fire department. You must be able to systematically identify and/or rule out accidental fire causes based on the evidence before you at a fire scene.

Evaluation:

The student will complete the formative and summative tests at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire & Explosion Investigations, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-26 through 921-32, Sections 5.7-5.7.4.3; Chapter 18: Fire Cause Determination, Pages 921-155 and 921-156, Sections 18.1-18.1.4; Chapter 19: Analyzing the Incident for Cause and Responsibility, Pages 921-158 and 921-159, Sections 19.1-19.2.1.4; Chapter 24: Appliances, Pages 921-199 through 921-208, Sections 24.1-24.6.15; and Chapter 26: Wildfire Investigations, Page 921-232, Section 26.7.2.3 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

- Topic:** #12: Electrical Ignition Sources
- Time Frame:** 2:00
- Level of Instruction:** Level II
- Authority:** 2009 Fire Investigator CTS #11: Electrical Ignition Sources
- Behavioral Objective:**
- Condition:** Given a formative and summative test
 - Behavior:** The student will describe electrical ignition sources, including the elements required for an electrically caused fire, the common electrical fire causes, and electrical fire indicators
 - Standard:** With a minimum 80% accuracy on the formative and summative tests according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 8: Electricity and Fire, Pages 921-66 through 921-90, Sections 8.1-8.12.8.5 and Chapter 24: Appliances, Pages 921-205 through 921-208 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 94-100
- Materials Needed:**
- Conference board/pads with markers/erasers
 - Appropriate audiovisual training aids and devices
- References:**
- NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 8: Electricity and Fire, Pages 921-66 through 921-90, Sections 8.1-8.12.8.5 and Chapter 24: Appliances, Pages 921-205 through 921-208
- Preparation:** Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.
- | | |
|---------------------|-------------|
| Attention (attract) | Begin |
| Curiosity (arouse) | Association |
| Interest (create) | Students |
| Desire (stimulate) | Experience |
- Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. ELECTRICAL VERSUS HYDRAULIC TERMINOLOGY</p> <p>A. Voltage (volt)</p> <ol style="list-style-type: none">1. Hydraulic<ol style="list-style-type: none">a) Water pump produces pressure to push water through a distribution system2. Electric generator<ol style="list-style-type: none">a) Produces voltage (pressure) to push electricity through a distribution system <p>B. Amperage (amp)</p> <ol style="list-style-type: none">1. Hydraulic<ol style="list-style-type: none">a) Water pump produces a quantity (gallons per minute)2. Electrical generator<ol style="list-style-type: none">a) Produces a quantity (amps) <p>C. Wire size</p> <ol style="list-style-type: none">1. Hydraulic<ol style="list-style-type: none">a) The bigger the pipe, the more water that can be distributed<ol style="list-style-type: none">1) Pipe measurement<ul style="list-style-type: none">• The bigger the number, the bigger the pipe2. Electrical<ol style="list-style-type: none">a) The bigger the wire, the more electricity<ol style="list-style-type: none">1) American wire gauge (awg)2) The bigger the number, the smaller the wire<ul style="list-style-type: none">• #10 awg wire is larger in diameter than #14 awg wire <p>D. Resistance</p> <ol style="list-style-type: none">1. Hydraulic<ol style="list-style-type: none">a) The pressure loss of a distribution system	<p>What is the difference between a volt and an amp?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>2. Electrical</p> <ul style="list-style-type: none">a) The voltage loss of a distribution system <p>II. HOME AND COMMERCIAL ELECTRICAL PROTECTIVE DEVICES</p> <p>A. Designs based on National Electrical Code (NEC) provide good basic safety in system</p> <p>B. Incoming power service is protected by a fuse or circuit breaker just beyond meter and/or main disconnect switch</p> <ul style="list-style-type: none">1. Fuse/breaker rated to correspond to power wattage demands of the structure<ul style="list-style-type: none">a) Normally 100 amperes or more depends on type of occupancy2. Incoming power may be 110 or 220 volts for residential occupancies3. Higher power demands usually found in commercial/industrial occupancies<ul style="list-style-type: none">a) 440 volts common in many occupancies4. NEC definitions<ul style="list-style-type: none">a) "Low voltage" as 0-600Vb) "High voltage" as 601V and higher <p>C. Distribution panel and overcurrent protection within the structure</p> <ul style="list-style-type: none">1. Feeder supply branch circuits2. Incoming main divided into secondary or branch circuits<ul style="list-style-type: none">a) Lighting circuitsb) Appliance circuitsc) Individual circuits may serve water heater, range, small appliances, etc.3. A branch circuit is defined as one which extends between the final overcurrent device (fuse/breaker) and the outlet	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>4. Wiring found in branch</p> <ul style="list-style-type: none"> a) General purpose branch circuits <ul style="list-style-type: none"> 1) Typically lighting circuits 2) Usually uses 12 gauge wire and carries up to 20 amperes 3) Protected by 20 amperes fuse/breaker b) Residential branch circuits supplying small appliances <ul style="list-style-type: none"> 1) Usually found in kitchens, dining room, laundry, and garage areas 2) Usually 12 gauge wire and carries up to 20 amperes 3) Protected by 20 amperes fuse/breaker c) Special purpose individual branch circuit <ul style="list-style-type: none"> 1) Supply only a limited number of appliances <ul style="list-style-type: none"> • Usually only one 2) Wire size and overcurrent protection installed as appropriate to the load supplied <p>D. Grounding</p> <ul style="list-style-type: none"> 1. Accomplished to provide a safe path for unintentional current flows to earth 2. Metal appliance frames, metal conduit, and other normally "uncharged" electrical equipment connected to "ground" 3. Neutral conductor may or may not be connected to ground <ul style="list-style-type: none"> a) Usually connected in settings 4. Ground connection usually to cold water pipe or ground rod 5. Loose connection or accidental current flow may energize appliances or other objects and cause shock and/or fire hazards 	<p>What does it mean to "ground" electricity?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>E. Overcurrent protection</p> <ol style="list-style-type: none">1. Current generates heat2. Excessive heat or current caused by<ol style="list-style-type: none">a) Overheating by drawing (demanding) excessb) Short circuits<ol style="list-style-type: none">1) Develop when two elements of different potentials contact2) Most common is the "ground" fault<ul style="list-style-type: none">• Hot wire in contact with ground or ground potential3) True short circuit<ul style="list-style-type: none">• "Hot" wire in contact with neutral wire4) Ground faults or true short circuits produce very large surges of current3. If properly designed and operating, excess heating or current surge should cause circuit breakers to trip or fuse element to melt<ol style="list-style-type: none">a) Certain devices will not "trip" during temporary surges or motor start upb) Produces open circuitc) Stops flow of current4. Typical overcurrent<ol style="list-style-type: none">a) Fuses<ol style="list-style-type: none">1) A fuse is, by design, the weakest portion of the circuit2) Fuse link melts and produces open circuitb) Edison fuses<ol style="list-style-type: none">1) Ordinary screw base up to 30 amperes2) 15 amperes or less have hexagonal window	<p>What occurs internally on a circuit breaker for a fuse to cause it to trip?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>3) Above 15 amperes but less than 30 amperes have round windows</p> <p>c) Type "S"</p> <p>1) Available in sizes to 30 amperes</p> <p>2) In three rating categories</p> <p>3) Each category is noninterchangeable with the other two categories</p> <p>d) Cartridge type</p> <p>1) Available in sizes up to 6000 amperes</p> <p>e) Many fuses have time lag designs which allow for momentary overcurrent without tripping</p> <p>1) Small copper springs can be seen in fuse windows</p> <p>f) Circuit breakers</p> <p>1) Usually contain a bimetal strip</p> <p>2) Bimetal element heats and bends opening contacts or tripping breaker</p> <p>3) Circuit breakers, by design, have a time delay feature built in</p> <p>4) Ground fault circuit is a sensitive circuit breaker</p> <ul style="list-style-type: none"> • Has test feature <p>III. EXAMINING FIRES OF ELECTRICAL ORIGIN</p> <p>A. Service/distribution area (area around service panel)</p> <p>1. Edison fuses</p> <p>a) When overheating occurs</p> <p>1) Resulting heat (energy release) from sudden current surge usually causes sight glass to discolor (dark spot on glass)</p> <p>2. Cartridge fuses</p> <p>a) Condition of fused link can be determined by disassembling fuse and inspecting link</p>	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 3. Circuit breakers <ul style="list-style-type: none"> a) May have been taped in the "on" position in hopes of over-riding trip b) May have some device added to hold in "on" position (broom or mop handles often used) c) May be clogged with debris 4. Connections in switch panel <ul style="list-style-type: none"> a) Evidence of tool marks on cover plate b) Cover plate removed c) Terminal connections tight 5. Check area for blown or discarded fuses <ul style="list-style-type: none"> a) Indicated possible trouble prior to the fire 6. Bridged fuses (screw socket) <ul style="list-style-type: none"> a) Pennies in fuse socket b) Spark plugs have been used to bridge fuse socket connections c) Fuse may be altered d) Fuse may be replaced by other device to bridge socket connections e) Type "S" fuses very difficult to bridge 7. Bridged fuses (ferrule or blade type, cartridge fuse) <ul style="list-style-type: none"> a) Fuses wrapped in foil b) Fuses replaced by solid metal bars or metal tubes c) "Jumper cables" used to bridge fuse connections 8. Check for heavy oxidation on ground connection in service panel <ul style="list-style-type: none"> a) Shows evidence of current flow through ground conductors (abnormal) 	<p>Why is this significant?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

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<p>2. Copper wiring usually melts at approximately 2000°F</p> <ul style="list-style-type: none"> a) Most structural fires do not produce sufficient heat to melt most copper wiring (some local melting may occur) b) Heat-damaged copper wire usually results in sharp pointed ends (if multi-stranded, cable may appear ragged with several pointed ends) <ul style="list-style-type: none"> 1) Some blistering may occur on wire surfaces 2) Wire may show areas of thin diameters (due to the drawing of the heated wire) 3) Wire may appear to have been lacquered (sometimes occurs as a result of burned insulation) c) Heat damaged wire may have insulation remaining <ul style="list-style-type: none"> 1) Insulation may be tightly bonded to wire (caused from external heat melting insulation and burning of insulation from outside) <p>3. Damaged copper wiring may indicate electrical short circuit</p> <ul style="list-style-type: none"> a) Sparks produced by electrical short circuits generate temperatures of from 2000°F to 7000°F b) Short-circuited arcs may produce local damage to wiring at point of origin <ul style="list-style-type: none"> 1) Copper may melt and spatter on nearby surfaces 2) Beads may form at the ends of smaller wires or strands of cable 3) Beading, the result of arcing, is usually smooth with heat rings visible on the bead when viewed under low magnification 4) Beading, the result of an external heat source, will usually have an "Orange Peel" effect when viewed under low magnification 	<p>What is the significance of melted copper wire?</p>



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<ul style="list-style-type: none"> 5) Cavities may form on ends of larger cables c) Insulation may indicate type of heat present <ul style="list-style-type: none"> 1) Insulation heated from overcurrent may char insulation from within which expands and produces sleeve over wire (insulation may be loose on the wire or cable) 2) Insulation heated from an external source (fire) may bond tightly to wire or cable 4. Short circuits may have developed during the fire <ul style="list-style-type: none"> a) Evidence of a short circuit or overcurrent does not, in itself, indicate or prove the electrical short to be the fire cause b) Flexible metal conduit may develop cavities from "blow outs" from short circuits caused by heating of cable (wire) during the fire c) Charred insulation becomes a semiconductor and as electricity passes through localized arcing and bead can occur <p>NOTE: The student should be cautioned that this condition occurs more often as the result of external heat and therefore, does not necessarily indicate the fire cause.</p> <ul style="list-style-type: none"> 5. Evidence of short circuits close to the point of origin indicate the need for additional investigation 6. Check wire size in circuits for conformance with industry standards and code requirements 7. Evaluate circuit containing suspected electrical fire cause <ul style="list-style-type: none"> a) Trace wiring back to distribution panel <ul style="list-style-type: none"> 1) Loose connection (are screw heads tight?) 2) Bridged fuses/breakers 3) Recent repairs attempted <p>D. Sources of investigative assistance</p> <p>NOTE: The following sources may understand current flow but <u>not</u> heat generation.</p>	



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<ol style="list-style-type: none"> 1. City, county, or state electrical inspection division 2. Electrical contractors 3. Utility companies <p>IV. ALUMINUM WIRING</p> <p>A. Aluminum wiring began to be used in about 1946</p> <p>B. Aluminum expands and contracts approximately 38% more than copper</p> <p>C. Aluminum wire oxidizes more freely than copper wire</p> <ol style="list-style-type: none"> 1. Connections which have oxidized develop resistance heating qualities, thereby causing additional oxidation <p>D. Oxidation and expansion at connections may cause connector to become loose</p> <p>E. Aluminum and copper react (electrolysis) and aluminum may corrode</p> <ol style="list-style-type: none"> 1. Lowers current safety limit due to the reduced cross section of the aluminum wire <p>F. Proper connectors must be used for aluminum-to-copper connections</p> <ol style="list-style-type: none"> 1. Connectors often marked as follows <ol style="list-style-type: none"> a) AL/CU (aluminum and copper) b) Connector painted white (aluminum and copper) c) Splice may require use of anti-oxidation paste <p>V. ELECTRICAL EQUIPMENT APPLIANCES AND FIRES</p> <p>A. Incandescent light bulbs</p> <ol style="list-style-type: none"> 1. Used as a fire cause <ol style="list-style-type: none"> a) Can cause ignition of combustible materials such as cloth, sawdust, or tissue paper 	<p>Why does aluminum wiring have the greater potential for causing fires?</p>



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<ol style="list-style-type: none"> 2. Temperatures generated by light bulbs depend on the following factors <ol style="list-style-type: none"> a) Power draw (wattage) b) Shape c) Position (orientation) of bulb 3. Light bulbs in contact with thin combustibles often produce localized scorching 4. Indicators of light bulbs as fire cause <ol style="list-style-type: none"> a) Heavy staining of bulb fragments b) Combustible ash may be stuck to bulb/fragments c) A short circuit may develop near the bulb/socket d) Point of origin very near e) Usually long periods of time with no occupants in area of origin 5. Laboratory may be able to determine if bulb was "on" at time of the fire by examination of filament remains 6. Clean filament can suggest bulb off prior to glass breaking 7. Burned/discolored filament can suggest bulb on prior to glass breaking 8. Softening or blowing out of bulb from heat may indicate direction of fire's progress 9. Filament temperature can be up to 6,000°F 10. Filament arc temperature can be up to 2,000°F to 6,000°F <p>B. Lighting fixtures</p> <ol style="list-style-type: none"> 1. Improperly installed lighting fixtures may cause fires in nearby combustible construction materials (joists, studs, insulation, etc.) <ol style="list-style-type: none"> a) May be very slow starting and may be characteristic of low temperature ignition (pyrophoric carbon) b) Point of origin and very deep charring in area of origin 	



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<ul style="list-style-type: none"> 2. Fluorescent fixtures may develop malfunction or breakdown of ballast transformer(s) <ul style="list-style-type: none"> a) Ballast transformers may contain filler materials (potting compound) that will melt and run at higher temperatures b) Improperly operating ballast transformers may develop extreme temperature and self-ignite or ignite other nearby combustibles c) Fluorescent tubes will not usually cause ignition or ordinary combustibles C. Small electric appliances <ul style="list-style-type: none"> 1. Many small appliances have thermal controls, high limit switches, thermostats, and/or current overload protective devices <ul style="list-style-type: none"> a) Controls are usually constructed of bimetal strips b) Control points may be pitted or fused together thus allowing overheating c) Contact points should be examined for fusing or pitting D. Electric motors <ul style="list-style-type: none"> 1. Bronze bearings usually do not freeze (stick or lock) from external fire damage 2. Fuses at motor controllers or disconnects should be examined 3. Contact points should be examined for fusing or pitting 4. Damage to the inside surface of drive belts at the point of contact with pulleys may indicate friction heat build-up 5. Electric motor wiring insulation (clear varnish appearance) usually is burned away only when motor burns out <ul style="list-style-type: none"> a) External fire damage usually does not destroy motor wiring insulation 	



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<p>6. Motors which retain high temperature after other metal objects in the same area have cooled may indicate internal heating (consider mass of each object)</p> <p>E. Electric blankets (or heating pads)</p> <ol style="list-style-type: none"> 1. Fires caused by electric blankets frequently due to misuse by owner <ol style="list-style-type: none"> a) Manufacturer's instructions and safe use require that blankets not be covered by other bed coverings, or be folded or tucked under mattresses b) Accidental fires have developed from misuse, such as <ol style="list-style-type: none"> 1) Individuals or animals sleeping on top of blankets 2) Blankets being left on for a long period of time 2. Often difficult to distinguish differences between fire caused by electric blanket or fire caused by a cigarette in or on a mattress <p>F. Televisions, radios, stereos, and home entertainment systems</p> <ol style="list-style-type: none"> 1. Installation of systems into cabinets or corners may produce excessive heat build-up <ol style="list-style-type: none"> a) Televisions are designed to operate in areas of adequate ventilation 2. Dust build-up inside set may produce arcing and cause ignition of plastic components and/or case 3. Many televisions operate at voltages of up to 32,000 volts in some areas within the set and can attract dust through electrical charges <ol style="list-style-type: none"> a) Failure of these high voltage components may cause extreme heat and ignition 	<p>Has anyone responded to a fire involving an electric blanket?</p>



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<p>4. Television failure may be due to failure to set's power switch</p> <p style="margin-left: 20px;">a) Some sets are thought to use switches of light or less than heavy duty design</p> <p>5. Prior trouble with set may indicate possible investigative leads</p> <p>6. Burning sets may increase the amount of fire damage</p> <p style="margin-left: 20px;">a) May produce floor charring similar to furniture fires</p> <p style="margin-left: 20px;">b) Cabinets may melt and collapse to produce intense localized heat</p> <p>VI. QUESTIONS TO BE ANSWERED IN ANY FIRE SUSPECTED TO HAVE BEEN CAUSED FROM ELECTRICAL SOURCES</p> <p>A. Was the electricity on before the fire?</p> <p>B. Was the electricity on at the time of the fire?</p> <p>C. Did the local utility company respond to the fire?</p> <p>D. Have there been any recent problems of an electrical nature in the building?</p> <p>E. Have there been any blackouts or brownouts?</p> <p>F. Have the fuses been blowing?</p> <p>G. Have the circuit breakers been tripping?</p> <p>H. Has the local utility company been called, or have a service personnel been seen on the premises in recent days?</p> <p>I. Did the lights seem to dim, or get dim at peak hours of electrical usage?</p> <p>J. Did the lights flicker or dim when appliances were turned on?</p> <p>K. Did appliances start or operate slowly?</p>	<p>What types of questions should be asked?</p>



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<ul style="list-style-type: none"> L. Did the television picture shrink or fade when appliances were turned on? M. Did the radio scratch or fade when appliances were turned on? N. If there have been any electrical problems, what, if anything, has been done to alleviate them? O. Had a handyperson or janitor been working on the electrical system? P. Has the owner or manager been working on the electrical system? Q. Has any other authorized or unauthorized person been working on the electrical system? R. Has an electrical contractor been working on the electrical system? If so, who? S. Why was the electrical contractor called? T. Was the electrician called to alleviate a problem, for an addition, remodeling, or for new work? U. Is the contractor licensed? Is there a permit for the job? If so, where is it? V. Has the job been completed? <p>VII. STATIC ELECTRICITY AS A FIRE CAUSE</p> <ul style="list-style-type: none"> A. Requires movement of some type B. Occurs when objects of different charges or potentials contact one another, then separate <ul style="list-style-type: none"> 1. Occurs at all times, but is more noticeable during cold, dry weather 2. May result in accidental fires, especially in areas where flammable liquids or gases are present C. Flammable container ground wires or bonding straps indicate static hazards 	



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Fire Origin and Cause Determination

Summary:

Establishing an accurate fire cause is one of the primary responsibilities of a fire department. You must be able to systematically identify and/or rule out electrical fire causes based on the evidence at a fire scene.

Evaluation:

The student will complete the formative and summative tests at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, 2008 Edition, Chapter 8: Electricity and Fire, Pages 921-66 through 921-90, Sections 8.1-8.12.8.5 and Chapter 24: Appliances, Pages 921-205 through 921-208 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 94-100 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #13: Incendiary Fire Indicators

Time Frame: 3:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #12: Incendiary Fire Indicators

Behavioral Objective:

Condition: Given an activity and summative test

Behavior: The student will describe the unusual situations which help know incendiary fires, and the indicators which suggest the presence of an ignitable liquid

Standard: With a minimum 80% accuracy on the summative test according to the information contained in NFPA 921: Guide to Fire and Explosion Investigations, NFPA, 2008 Edition, Chapter 6: Fire Patterns, Pages 921-41 and 921-42, Sections 6.2.5-6.2.5.3, Chapter 10: Fire-related Human Behavior, Pages 921-99 through 921-101, Sections 10.4, 10.6, and 10.7, Chapter 18: Fire Cause Determination, Page 921-156, Sections 18.2-18.2.6, and Chapter 22: Incendiary Fires, Pages 921-184 through 921-188, Sections 22.1-22.4.8.3 and successfully completing Group Activity 13-1

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 13-1: What Would I Look For?

References:

- Kirk's Fire Investigation, John DeHaan, Sixth Edition, Pages 143-196 and 408-411
- NFPA 921: Guide to Fire and Explosion Investigations, NFPA, 2008 Edition, Chapter 6: Fire Patterns, Pages 921-41 and 921-42, Sections 6.2.5-6.2.5.3, Chapter 10: Fire-related Human Behavior, Pages 921-99 through 921-101, Sections 10.4, 10.6, and 10.7, Chapter 18: Fire Cause Determination, Page 921-156, Sections 18.2-18.2.6, and Chapter 22: Incendiary Fires, Pages 921-184 through 921-188, Sections 22.1-22.4.8.3

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.



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Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



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<p>C. Common trailer materials</p> <ol style="list-style-type: none"> 1. Newspapers 2. Rope, string, twine, etc. 3. Fuse <ol style="list-style-type: none"> a) May produce "skip" char pattern - safety fuse b) May leave asphalt-like residue - pyrotechnic or cannon fuse 4. Clothing, bed clothes, drapes, other household materials 5. Kindling (wood) 6. Waxed paper or tissue paper in combination with an ignitable liquid 7. Ignitable liquids <ol style="list-style-type: none"> a) Gasoline b) Kerosene c) Alcohol <ol style="list-style-type: none"> 1) May be difficult to detect 2) Water soluble 3) Scented alcohol d) Lighter fluid e) Any other common and/or readily available liquid fuel <ol style="list-style-type: none"> 1) Lacquer thinner 2) Acetone <p>III. PRESENCE OF IGNITABLE LIQUIDS</p> <p>A. The terms "flammable accelerant" and "ignitable liquids" have been used interchangeably</p>	<p>What are the common materials/method of constructing a trailer?</p>



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<ol style="list-style-type: none"> 2) However, the "V" pattern may be due to the effect of radiant heat alone 3) Samples need to be taken for analysis and comparison <ol style="list-style-type: none"> 2. The ignitable liquid may run through flooring <ol style="list-style-type: none"> a) May produce burning under the floor b) Ignitable liquid residue may be recovered from under flooring or soil beneath 3. Ignitable liquids may settle to lowest parts of floor area <ol style="list-style-type: none"> a) Area where building is settling b) Area of heavy occupant travel or use 4. Ignitable liquids may produce charring in puddle or spill patterns <ol style="list-style-type: none"> a) Rainbow effect; rainbow-colored residue or sheen appearance floating on top of water run off <ol style="list-style-type: none"> 1) Oily substances that do not mix with water float and create light diffraction patterns 2) Common at fire scenes 3) May not be ignitable liquids due to pyrolysis <ul style="list-style-type: none"> • Asphalt • Plastics • Wood with high oil content 4) Samples need to be sent for analysis 5. Ignitable liquids may soak into any absorbent material <ol style="list-style-type: none"> a) Carpet <ol style="list-style-type: none"> 1) A distinct pattern may be formed 2) Older carpets will produce such patterns in area of heavy traffic 	<p>Where will liquids tend to settle or pool?</p>



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<ul style="list-style-type: none"> b) Floor length drapes c) Debris may first have to be removed before pattern is identified d) Sheetrock at floor level may absorb ignitable liquids <ul style="list-style-type: none"> 1) Sweep and rinse floor 2) Water poured onto floor may indicate area of settling 6. Ignitable liquids may produce unusual burning of contents and/or building components <ul style="list-style-type: none"> a) Burning on the bottom edge of doors b) Burning of floor surfaces along edge at contact with walls c) Ignitable liquids may be found behind baseboards d) Significant charring of the underside of most furniture is usually unnatural unless ignitable liquids are present 7. Fire fighters may have witnessed "flashbacks" while attempting to extinguish the fire 8. Spalling of concrete <ul style="list-style-type: none"> a) Great care must be used while evaluating the significance of spalled concrete b) Spalling is the breakdown of tensile strength in concrete, masonry, or brick c) Spall indicates extreme heat and/or rapid cooling, and can be found on concrete, brick, or other similar surfaces d) Spalling can occur naturally in non-fire environments such as freezing climates e) Not a positive indicator of the use of ignitable liquids and/or an incendiary fire 	<p>Is spalling a positive indicator of incendiary activity?</p>



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<p>9. Charring as an indicator of ignitable liquids</p> <ol style="list-style-type: none"> a) Deep charring next to undamaged surfaces may indicate ignitable liquids b) Charring of areas that should be protected c) These characteristics only suggest the presence of liquid accelerants <p>E. Ignitable liquids may soak into floors and cause holes as a result of the burning</p> <ol style="list-style-type: none"> 1. Consider the type of flooring 2. Consider the area and condition of the flooring <ol style="list-style-type: none"> a) Constant lubricating of machinery or equipment b) Wood <ol style="list-style-type: none"> 1) Old 2) Rotting 3) Dry rot <p>F. Ignitable liquid accelerant may produce an even burn over appearance</p> <p>G. Discovery of ignitable liquid containers</p> <ol style="list-style-type: none"> 1. May provide comparison sample for laboratory analysis 2. If container is not damaged it may help to prove lack of spread of accelerant due to explosion 3. May provide fingerprints 4. When located in an area not normally used to store ignitable liquids <p>H. Ignitable liquid odors detected by fire fighters</p> <p>NOTE: Remind students that products of combustion affect the ability to smell, and are likely toxic.</p> <p>I. Residue of ignitable liquids may be detected by use of hydrocarbon detectors or canines specifically trained to detect particular ignitable liquids</p> <ol style="list-style-type: none"> 1. Ignitable liquid alerts are not conclusive 2. Requires further analysis and confirmation by laboratory examinations 	



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Fire Origin and Cause Determination

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<p>IV. USE OF COMMON EQUIPMENT AND/OR APPLIANCES</p> <p>A. Common household, commercial and/or industrial equipment or appliances used as incendiary devices</p> <ol style="list-style-type: none"> 1. Heating equipment 2. Cooking equipment 3. Lighting equipment <p>B. Often difficult to prove intent they initiated a fire</p> <ol style="list-style-type: none"> 1. A fire near gas or electrical equipment, appliances, or fireplaces may be intended to make the fire appear to be from an accidental cause. 2. May be evidence of <ol style="list-style-type: none"> a) Tampering or modification of the wiring system b) Movement or arrangement of heat-producing appliances to locations near combustible materials c) Combustible materials being placed on or near heat-producing appliances <p>C. Indicators in area of investigative examination</p> <ol style="list-style-type: none"> 1. Check for evidence of combustible fuel being arranged nearby 2. Heating equipment <ol style="list-style-type: none"> a) Check control settings b) Check for tool marks on fuel supply lines c) Check for tampering with fuel supply lines, wiring, etc. 3. Cooking equipment <ol style="list-style-type: none"> a) Check control setting b) Check for tool marks on fuel supply lines c) Check for tampering with fuel supply lines, wiring, etc. 	<p>What type of appliances could be used to stage an accidental fire?</p>



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<p>4. Lighting equipment</p> <ul style="list-style-type: none"> a) Check for evidence of lighting equipment in unnatural location b) Determine if lighting equipment was energized prior to fire start c) Attempt to determine bulb wattage <p>V. STRUCTURAL DAMAGE/CONTENT IRREGULARITIES PRIOR TO THE FIRE</p> <p>A. Structural damage prior to the fire</p> <ul style="list-style-type: none"> 1. Holes in walls, floors, or ceilings to allow fire to spread 2. Damage itself could be accidental <ul style="list-style-type: none"> a) Due to poor building upkeep b) Result of the suppression activity 3. Fire protection systems damaged <ul style="list-style-type: none"> a) Smoke and heat detectors tampered with or broken b) Sprinklers and standpipes tampered with c) Alarm systems turned off <p>B. Removal of contents prior to fire</p> <ul style="list-style-type: none"> 1. Expensive, antique, or objects of sentimental value may be removed 2. Inventory or remaining contents may identify missing items when compared to proof-of-loss statement 3. Neighbors may have noticed removal of contents 4. Neighbors may be able to identify missing objects <p>C. Substitution of contents</p> <ul style="list-style-type: none"> 1. Owner may remove usable contents and replace with junk furnishings <ul style="list-style-type: none"> a) Arsonist hopes investigator cannot identify quality of contents b) Arsonist thinks total destruction will cover the switch 	



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<ul style="list-style-type: none"> 2. Neighbors may have witnessed exchange of contents 3. Sources of used furniture may aid investigation <ul style="list-style-type: none"> a) Used furniture stores b) Goodwill Industry stores c) Salvation Army stores 4. Places used to store valuable contents <ul style="list-style-type: none"> a) Home or business of friends or relatives b) Storage rental firms c) Detached building on the property D. Contents out of place or contents not assembled <ul style="list-style-type: none"> 1. Owner/occupant may stack or pile combustible contents to provide fuel for the fire 2. Used or junk furniture may be brought into the structure but left unassembled 3. Commercial stock <ul style="list-style-type: none"> a) Out of date b) Damaged c) Seasonal d) LPG bottles placed in building with valves in the "on" position 4. Major cost items may be removed and substitution items may or may not be used 5. Substitution appliances may not be connected to power outlets or fuel lines 6. Substitution appliances may be empty, in bad repair, or in bad physical condition 7. Substitution appliances may not fit area of installation <ul style="list-style-type: none"> a) Check floor at cut-out area for indications that unit does not fit b) Check for indentations from leveling screws or leg buttons 	<p>Where can you buy used furniture?</p>



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Fire Origin and Cause Determination

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<p>E. Absence of personal items</p> <ol style="list-style-type: none"> 1. Most homes and businesses contain personal items 2. Absence of personal items may indicate incendiariism <ol style="list-style-type: none"> 3. Examples of personal items which are frequently removed prior to a set fire <ol style="list-style-type: none"> a) Business, commercial, or industrial occupancies <ol style="list-style-type: none"> 1) Hand tools 2) Portable power tools 3) Work clothing (uniforms) 4) Business machines (typewriter, check writers, calculators, computers, etc.) 5) Guns 6) Petty cash 7) Radios, televisions, personal electronic equipment 8) Business records b) Residential occupancies <ol style="list-style-type: none"> 1) Expensive clothing 2) Jewelry 3) Family photographs 4) Family records (birth certificates, family bible, etc.) 5) Hobby equipment 6) Guns 7) Tools 8) Sports equipment 	<p>What are some examples of personal items removed from both business and residential occupancies?</p>



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<p>F. Absence of important papers</p> <ol style="list-style-type: none"> 1. Insurance policies 2. Marriage and church records 3. Checking and savings account books 4. Titles and deeds 5. School records 6. Wills <p>VI. FIRE LOCATION AND DAMAGE</p> <p>A. Unusual location of the fire origin</p> <ol style="list-style-type: none"> 1. Middle of bed 2. Center of floor 3. Closet <p>B. Evidence of other crimes in the structure</p> <ol style="list-style-type: none"> 1. Fire may have been set to cover other crimes 2. Other crimes could have been staged to help explain the set fire <p>C. Entry of fire companies blocked or response delayed</p> <ol style="list-style-type: none"> 1. Fire equipment can be prevented from leaving the station 2. Hydrants and fire department connections damaged 3. Structure secured to prevent easy access <ol style="list-style-type: none"> a) Gates locked b) Trees down c) Driveway barricaded 4. Diversion fires 5. Entry doors blocked and barricaded <p>D. View into structure blocked</p> <ol style="list-style-type: none"> 1. Used to delay discovery of the fire 	<p>What could be significant about the location of the fire?</p>



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<ul style="list-style-type: none"> a) Doors/windows painted over b) Doors/windows covered with black plastic or black construction paper c) Contents arranged to block view <p>2. Evidence should remain which would indicate such a situation</p> <p>E. Injuries to occupants</p> <ul style="list-style-type: none"> 1. Sometimes the result of premature or delayed ignitable liquid ignition <ul style="list-style-type: none"> a) Obtain medical treatment reports <ul style="list-style-type: none"> 1) Medical records are not easy to get 2) Requires special master b) Victims clothing should also be taken for analysis for ignitable liquids, particularly shoes and pants c) Photograph injuries <p>F. Second fire in the same structure</p> <ul style="list-style-type: none"> 1. May be accidental rekindle of first fire and therefore, must be proved otherwise 2. First fire may cause damage that has to be considered with second fire 3. Fire may not have been reported <p>G. Presence of burned or unburned newspapers at or near point of origin</p> <ul style="list-style-type: none"> 1. Newspapers are a readily available kindling material <ul style="list-style-type: none"> 2. Retain as evidence and examine for <ul style="list-style-type: none"> a) Publishing company b) Date of publication c) Out of town papers d) More than one copy with the same date 	<p>What type of information is gained from recovered newspapers?</p>



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>H. Fire occurring during non-business hours</p> <ol style="list-style-type: none"> 1. Provides arsonist necessary set-up time when workers are away 2. Provides excuse for owner to be out of town 3. Fewer people normally in area <ol style="list-style-type: none"> a) Holiday b) Weekend c) Local special events 4. Arsonist believes there is less chance of physical injury to others <p>I. Time of day</p> <ol style="list-style-type: none"> 1. Determine if fire cause or occupant's explanation of fire is consistent with time of fire 2. Occupants dress consistent with time of day 3. Kitchen fire at times other than normal meal times 4. Sofa fire during daylight hours (structure also occupied) <p>J. Water heater fires</p> <ol style="list-style-type: none"> 1. Fire resulting from modern water heaters are rare <ol style="list-style-type: none"> a) Due to built-in safety features b) Due to building requirements 2. Examine for evidence of self-repair or tampering 3. Examine area for evidence of ignitable liquids <p>K. Fire during renovations</p> <ol style="list-style-type: none"> 1. Accidental fires do frequently occur <ol style="list-style-type: none"> a) Presence of combustible and/or flammable materials b) Poor housekeeping c) Power tools and other temporary heat sources 	<p>Are water heaters a common fire cause?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. Owner/occupant may discover renovations not producing expected results 3. Actual cost exceeding initial estimates and therefore cash problem 4. Moratorium on building permits <p>L. Fire during electrical storms</p> <ul style="list-style-type: none"> 1. Has been used as convenient blame for intentionally set fires 2. Available indicators would not be consistent with electrical storm fire <p>M. Reported activities of owners/occupants</p> <ul style="list-style-type: none"> 1. Unusual arrivals and departures 2. Moving furniture or belongings in and out 3. Change in demeanor toward the neighbors <p>N. Evaluate information obtained from neighbors and/or witnesses</p> <ul style="list-style-type: none"> 1. Compare to statements of owners/occupants 2. Complaints about structure 3. Arguments with neighbors 4. Domestic problems 5. Attempts to sell structure <p>VII. PROCESS OF ELIMINATION</p> <p>A. Any determination of fire cause should be based on evidence rather than on the absence</p> <ul style="list-style-type: none"> 1. The positive identification of the origin is the most significant factor in determining whether the process of elimination is appropriate 2. A clearly defined origin exists when it is known conclusively to the exclusion of all other potential origins 	<p>Why is it important to investigate cause during an electrical storm?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>B. The process of elimination is not to be used indiscriminately</p> <ol style="list-style-type: none"> 1. Whenever the origin is not clearly defined, this process is inappropriate and cannot be used 2. The “elimination of all accidental causes” to reach a conclusion that a fire was incendiary is a finding that can rarely be justified scientifically, using only physical data 3. "Elimination of all causes other than the application of an open flame" is a finding that may be justified in limited circumstances <ol style="list-style-type: none"> a) Where the area of origin is clearly defined b) All other potential heat sources at the origin can be examined and credibly eliminated 4. May be difficult to prove to the satisfaction of the court or jury 5. Formerly known as negative corpus <p>C. Examples</p> <ol style="list-style-type: none"> 1. A wildland fire started along a roadway by a person using a lighter (hot set) 2. A person starting a fire in ordinary combustibles using an open flame source and removing it from the scene <p>VIII.INDICATORS AS "EVIDENCE" OF ARSON</p> <p>A. All indicators may help prove incendiarism and therefore must be properly documented, collected, recorded, stored, and/or preserved</p> <p>B. Ways to document identified indicators</p> <ol style="list-style-type: none"> 1. Reports 2. Photographs 3. Sketches 4. Collect as evidence 	<p>What are some examples?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

A fire scene offers numerous indicators which may assist an investigator and fire personnel in determining whether the cause of the fire was arson (incendiary). Remember, one single indicator serves to suggest, not prove, the presence of arson.

Evaluation:

The student will complete the activity and summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosion Investigations, NFPA, 2008 Edition, Chapter 6: Fire Patterns, Pages 921-41 and 921-42, Sections 6.2.5-6.2.5.3, Chapter 10: Fire-related Human Behavior, Pages 921-99 through 921-101, Sections 10.4, 10.6, and 10.7, Chapter 18: Fire Cause Determination, Page 921-156, Sections 18.2-18.2.6, and Chapter 22: Incendiary Fires, Pages 921-184 through 921-188, Sections 22.1-22.4.8.3 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Group Activity 13-1: What would i look for?

Time Frame: 0:30

Materials Needed: • Conference board/pads with markers/erasers

Introduction: This activity provides the students the opportunity to study the materials and actions or idiosyncrasies used by people who intentionally and willfully promote or extend an unwanted fire.

Directions:

1. Divide the students into two groups.
2. Using the conference pads, have each team develop a list of as many indicators at a fire scene that may show there is possible incendiary activity.
3. The two teams have 15 minutes to complete this portion of the activity.
4. Each team must select a spokesperson.
5. The spokesperson will present their team's list of indicators to the class for discussion.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #14: Incendiary Devices

Time Frame: 1:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #13: Incendiary Devices

Behavioral Objective:

Condition: Given a summative test

Behavior: The student will describe the types of incendiary devices and their affects, how incendiary devices ignite, and incident scene procedures, which would include personal safety, investigation techniques, and scene security

Standard: With a minimum 80% accuracy on the summative test according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 22: Incendiary Fires, Page 921-185, Sections 22.2.4-22.2.7.3.2 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 103-107

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 22: Incendiary Fires, Page 921-185, Sections 22.2.4-22.2.7.3.2

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)

Curiosity (arouse)

Interest (create)

Desire (stimulate)

Begin

Association

Students

Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. INCENDIARY DEVICE CONSTRUCTION</p> <ul style="list-style-type: none">A. Components<ul style="list-style-type: none">1. Incendiary material<ul style="list-style-type: none">a) A material that burns with a flame for a period of timeb) Its usual purpose is to set fire2. Delay mechanism<ul style="list-style-type: none">a) Chemical, electrical, or mechanical elements that provide a time delayb) Elements may be used singularly or in combinationsB. Often constructed from readily available materials<ul style="list-style-type: none">1. Material found in every day use2. When used separately, individual material may be safe and harmless3. Difficult for the investigator to establish the intended use of the materialsC. Design<ul style="list-style-type: none">1. Directions or plans for construction are available to the arsonist from many sources<ul style="list-style-type: none">a) Underground movementsb) Bookstoresc) Mail order companiesd) The internetD. Toxic gases, heat, and chemical reaction times are not predictable<ul style="list-style-type: none">1. Reaction may be more violent than expected <p>II. ELECTRICAL INCENDIARY DEVICES</p> <p>NOTE: Electrical and mechanical incendiary devices are rare and only deserve brief discussion.</p> <ul style="list-style-type: none">A. Almost any electrical equipment or appliance may be used as part of an incendiary device<ul style="list-style-type: none">1. To produce spark	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. To produce heat 3. To activate some other device (timer) B. Electrical incendiary devices may also be classified by some other device action <ul style="list-style-type: none"> 1. Example: A battery could be used to heat a coil that would ignite nearby chemicals <ul style="list-style-type: none"> a) This device could be classified as both an electrical device and a chemical device C. Examples of common electrical devices <ul style="list-style-type: none"> 1. Light bulbs placed in or on combustibles <ul style="list-style-type: none"> a) Heat produced by light bulb depends on design, wattage, and position of the bulb b) Remaining evidence <ul style="list-style-type: none"> 1) Light bulbs found in unusual locations 2) Charred combustible fragments adhering to the remains of the bulb 2. Electrical appliance used for arson <ul style="list-style-type: none"> a) Heating devices <ul style="list-style-type: none"> 1) Heating coils placed in or on combustibles 2) Soldering irons placed in or on combustibles 3) Portable heaters placed near or in combustibles b) Electrical clocks, watches, and timers <ul style="list-style-type: none"> 1) Connected to blasting caps (must have additional electrical power supply) c) Remaining evidence <ul style="list-style-type: none"> 1) Electrical appliances found in unusual locations 2) Electrical appliances used at improper times <ul style="list-style-type: none"> • Electrical heater being used during hot weather 	<p>What's an example?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>D. Exotic accelerants</p> <ol style="list-style-type: none">1. Mixture of fuels and oxidizers<ol style="list-style-type: none">a) Exceedingly hot fire<ol style="list-style-type: none">1) Thermite mixtures<ul style="list-style-type: none">• Iron oxide(rust) and powder aluminum <p>V. EXAMPLES OF COMMON INCENDIARY DEVICES</p> <p>A. Cigarette and match delay</p> <ol style="list-style-type: none">1. Time delays of 5 to 25 minutes<ol style="list-style-type: none">a) Some cigarettes extinguish themselvesb) Depends on length of cigarette, tightness of tobacco, and whether or not match is fully inserted into cigarettec) Matches bundled around cigarette provide additional fire intensityd) High degree of failure <p>B. Road flares (fuses)</p> <ol style="list-style-type: none">1. Ignition if flare may be delayed<ol style="list-style-type: none">a) Hobby or cannon fuse (model rocket fuse), cigarette and match<ol style="list-style-type: none">1) Hobby or cannon fuses are available at most hobby shops2. Flares may produce up to 1200°F3. Flares usually burn approximately 15 to 30 minutes4. Flares are available to various lengths and colors5. White/light gray hard slag or residue<ol style="list-style-type: none">a) Laboratory will identify strontium salt <p>C. Commercial fire starters</p> <ol style="list-style-type: none">1. Charcoal briquette lighters2. Pellet stove starters<ol style="list-style-type: none">a) Produce a very hot, intense flameb) Little or no residue after combustion	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>D. Military fire starters</p> <ol style="list-style-type: none"> 1. Usually contain gelled accelerant and uses pulls or trips for ignition <ol style="list-style-type: none"> a) Produce low intensity flame and burn for up to 5 minutes <p>E. Candles as incendiary devices</p> <ol style="list-style-type: none"> 1. May be used to ignite combustibles 2. May be used to trip device <ol style="list-style-type: none"> a) Candle burns string and allows contact of circuit wired to clothes pin b) Completion of electrical circuit causes model rocket igniter to heat and ignite incendiary materials or combustibles <ol style="list-style-type: none"> 1) Model rocket igniters are available in most hobby stores <p>F. Fireworks as incendiary devices</p> <p>NOTE: Have students cite personal experiences.</p> <ol style="list-style-type: none"> 1. Fireworks may be used to ignite and spread flammable accelerant <ol style="list-style-type: none"> a) Burning accelerant may be thrown over large area 2. Fireworks may be used to break container upon activation 3. Plastic bags of accelerant may be used in conjunction with fireworks <p>VI. INCENDIARY DEVICES DESIGNED TO BE THROWN</p> <p>A. Destructive device (Molotov Cocktail)</p> <ol style="list-style-type: none"> 1. Any breakable container which contains a flammable liquid with a flash point of 150°F or less and has a wick or similar device capable of being ignited 2. Straight gasoline 3. Gasoline and soap, rubber bands, or Styrofoam 	<p>What are some examples of trip devices?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 4. Self-igniting or hypergolic 5. Arsonist or bomber lights wick and throws cocktail 6. Cocktails often fail to operate or function properly because <ul style="list-style-type: none"> a) Thick glass bottle may not break on contact b) Bottle does not strike solid target c) Cocktail is thrown too soon <ul style="list-style-type: none"> 1) Wick self-extinguishes in flight d) Wick is not properly secured to bottle and falls away during flight <ul style="list-style-type: none"> 1) May produce small fire over long flight path <p>B. California Penal Code</p> <ul style="list-style-type: none"> 1. Section 12301: Definition of a destructive device <ul style="list-style-type: none"> a) Elements required <ul style="list-style-type: none"> 1) Breakable container 2) Flammable liquid with a flashpoint of 150°F or less 3) Wick or other means of ignition 2. Section 453: Flammable or combustible materials, incendiary devices; possession, manufacture or disposal; intent; penalty; exceptions <ul style="list-style-type: none"> a) Every person who possesses, manufactures, or disposes of any flammable, or combustible material or substance, or any incendiary device in an arrangement or preparation, with intent to willfully and maliciously use this material, substance or device to set fire to or burn any structure, forest land or property, shall be punished by imprisonment in the state prison, or in the county jail, not exceeding one year b) For the purposes of this section <ul style="list-style-type: none"> 1) "Disposes of" means to give, give away, loan, offer, offer for sale, sell, or transfer 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>2) “Incendiary device” means a device that is constructed or designed to start an incendiary fire by remote, delayed, or instant means, but no device commercially manufactured primarily for the purpose of illumination shall be deemed to be an incendiary device for the purposes of this section</p> <p>3) “Incendiary fire” means a fire that is deliberately ignited under circumstances in which a person knows that the fire should not be ignited</p> <p>c) Subdivision (a) does not prohibit the authorized use or possession of any material, substance or device described therein by a member of the armed forces of the United States or by firemen, police officers, peace officers, or law enforcement officers authorized by the properly constituted authorities; nor does that subdivision prohibit the use or possession of any material, substance or device described therein when used solely for scientific research or educational purposes, or for disposal of brush under permit as provided for in Section 4494 of the Public Resources Code, or for any other lawful burning</p> <p>d) Subdivision (a) does not prohibit the manufacture or disposal of an incendiary device for the parties or purposes described in this subdivision</p>	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

The use of incendiary devices may leave residue (evidence). The investigator needs to recognize the post-fire conditions of various incendiary devices in order to collect evidence of the device.

Evaluation:

The student will complete the summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 22: Incendiary Fires, Page 921-185, Sections 22.2.4-22.2.7.3.2 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 103-107 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

- Topic:** #15: Structure Fire Investigation
- Time Frame:** 2:00
- Level of Instruction:** Level II
- Authority:** 2009 Fire Investigator CTS #14: Structure Fire Investigation
- Behavioral Objective:**
- Condition:** Given a summative test
- Behavior:** The student will describe structure fire investigation, including procedures, safety precautions and equipment, the basic information to be recorded concerning the structure, how to properly secure the building, agencies which provide assistance, and the basic information the investigator should obtain from a witness during an interview
- Standard:** With a minimum 80% accuracy on the summative test according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-34 through 921-39, Sections 5.9-5.12, Chapter 6: Fire Patterns, Pages 921-39 through 921-59, Sections 6.1-6.4.1.2, Chapter 7: Building Systems, Pages 921-59 through 921-66, Sections 7.1-7.4.5, Chapter 9: Building Fuel Gas Systems, Pages 921-90 through 921-97, Sections 9.1-9.9.7.2; Chapter 14: Pages 921-118 through 921-120, Sections 14.1-14.4.3; and Annex A, Pages 921-270 and 921-271
- Materials Needed:**
- Conference board/pads with markers/erasers
 - Appropriate audiovisual training aids and devices
- References:**
- Essential Finding - A Study of Serial Arsonists, Federal Bureau of Investigation (FBI), National Center for Analysis of Violent Crime (NCAVC), 1994
 - NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-34 through 921-39, Sections 5.9-5.12, Chapter 6: Fire Patterns, Pages 921-39 through 921-59, Sections 6.1-6.4.1.2, Chapter 7: Building Systems, Pages 921-59 through 921-66, Sections 7.1-7.4.5, Chapter 9: Building Fuel Gas Systems, Pages 921-90 through 921-97, Sections 9.1-9.9.7.2; Chapter 14: Pages 921-118 through 921-120, Sections 14.1-14.4.3; and Annex A, Pages 921-270 and 921-271



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. ON ARRIVAL</p> <p>A. Inform the Incident Commander (IC) of arrival</p> <ol style="list-style-type: none">1. Determine from the IC the safety of the fire scene<ol style="list-style-type: none">a) Fire contained versus fire containment efforts continuingb) Structural stabilityc) Other hazardous material2. Question IC as to the reason investigator was called to the scene<ol style="list-style-type: none">a) Unless investigator is following standard operating procedure in responding<ol style="list-style-type: none">1) Possible evidence of incendiarism2) Deaths/injuries3) Inability to determine fire cause3. Inform the IC if personnel/equipment are needed after extinguishment<ol style="list-style-type: none">a) Scene securityb) Personnel for searching for evidence and/or removal of fire debrisc) Lighting equipment or equipment necessary to process the incident scene<ol style="list-style-type: none">1) The refueling of any fuel powered equipment should be done outside the perimeter of the fire scene4. Advise the IC if special procedures are required5. Cease or delay overhaul operations, etc.<ol style="list-style-type: none">a) Excessive overhaul prior to documentation and analysis of fire patterns can have an adverse effect on determining the origin and cause of the fire	<p>What is the importance of making contact with the IC?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> a) Personnel should be instructed that entry is to be denied to all spectators, occupants, owners, media, and other unauthorized personnel b) Individuals claiming to have authority are to be referred to the investigator c) Scene security personnel should be in work or dress uniform or should have proper identification <p>2. Inform IC of steps which have been taken to secure the incident scene</p> <p>B. Scene security</p> <ul style="list-style-type: none"> 1. After fire fighting operations have been completed, need to protect burn indicators and evidence from being destroyed or disturbed 2. Arrange for delay of overhaul operations 3. Arrange for needed personnel to control all points of entry <ul style="list-style-type: none"> a) Instruct security personnel to remain at points of entry and to not enter area of investigation b) Security personnel may decrease loss of evidence 4. Incident scene is often difficult to secure; however, entry of unauthorized personnel must be limited <ul style="list-style-type: none"> a) Owner/occupants will usually attempt to re-enter area b) Spectators/neighbors may often attempt to enter the structure to survey damage or to steal valuable property c) Arsonist may attempt to re-enter structure <ul style="list-style-type: none"> 1) To destroy evidence of incendiary device 2) To cover-up incendiarism 3) To attempt to mislead investigators 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>5. Investigator can avoid problems by</p> <ul style="list-style-type: none"> a) Locating and informing owners/occupants that their re-entry into structure will be delayed during scene examination b) Owners/occupants are often informed that their re-entry is not possible because <ul style="list-style-type: none"> 1) Fire companies have not completed their operations 2) Structure is unsafe (subject to collapse and/or re-ignition) 3) The cause of the fire is under investigation c) Investigator may arrange for (or suggest) occupants to be provided temporary shelter during scene examination <p>6. Maintain scene security without breaks in chain of control over structure</p> <ul style="list-style-type: none"> a) If investigator is not present when fire fighting and overhaul operations have been completed <ul style="list-style-type: none"> 1) Fire personnel should be instructed to remain on scene and inside structure until investigator arrives or 2) Police department should be instructed to remain on scene until investigator arrives <p>7. Fire investigations should determine the identity of the individual and the authority or entity that has possession or control of the property</p> <p>IV. FIRE SCENE RESPONSIBILITY IN FATAL FIRES</p> <p>A. Moving the body</p> <ul style="list-style-type: none"> 1. DON'T 2. Unless extenuating circumstances occur, do not move the body prior to the arrival of an investigator or coroner 3. Local policy may dictate options <ul style="list-style-type: none"> a) Contact local law enforcement or coroner 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>4. Factors involved in deciding to move the body</p> <ul style="list-style-type: none"> a) Uncertainty as to actual death of the victim <ul style="list-style-type: none"> 1) If in doubt remove and transport 2) This may eliminate later criticism <p>5. Many conditions/circumstances on or around the victim will aid the coroner, police, and fire investigator</p> <p>6. If the victim is moved, accurate notes, sketches, and photographs should immediately be made describing conditions</p> <ul style="list-style-type: none"> a) Observe area under victim b) Observe any objects in victim's hands <p>B. Secure the scene</p> <ul style="list-style-type: none"> 1. Assign personnel to the following <ul style="list-style-type: none"> a) Log and identify all persons entering and/or exiting scene <p>C. Notification of appropriate agencies</p> <ul style="list-style-type: none"> 1. Follow policy of your jurisdiction 2. Notification of at least one of the following agencies is usually required <ul style="list-style-type: none"> a) Law enforcement agency having jurisdiction b) Coroner <p>D. Fatal fire scene examination</p> <ul style="list-style-type: none"> 1. May be two individual investigations <ul style="list-style-type: none"> a) Fire origin and cause b) Death investigation 2. Where more than one agency is involved, the investigation should be a cooperative and coordinated effort <ul style="list-style-type: none"> a) This relationship must be established prior to the incident 	<p>Why would you want to move the body?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> b) Extension of fire to building exterior c) Venting of fire <ul style="list-style-type: none"> 1) Natural fire versus fire company venting 2) Identify hose line operations d) Removal of debris, furnishings, stock, supplies, etc. <ul style="list-style-type: none"> 1) Provide security for materials/debris which may aid in identifying point of origin or fire cause <p>2. Fire suppression, extinguishment, activities underway</p> <ul style="list-style-type: none"> a) Damaged and undamaged areas of the structure <ul style="list-style-type: none"> 1) Structure may suffer extensive damage after arrival of investigator 2) Areas of extensive damage may not indicate area of origin <ul style="list-style-type: none"> • Extension damage may result from fire which could not be reached by fire companies and/or fire streams • Other areas of the burning structure may have required more immediate attention b) Open burning visible flames which may indicate types of fuel being consumed <ul style="list-style-type: none"> 1) Photograph scene upon arrival <p>B. Color of flames and smoke</p> <ul style="list-style-type: none"> 1. Evaluate with caution <ul style="list-style-type: none"> a) Investigator often arrives on scene during later stages of the fire b) Most structures contain fuels with hydrocarbon bases and when burning, these fuels may produce smoke/flames which could mislead the investigator 	<p>Why notice both damaged and undamaged areas?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ol style="list-style-type: none"> 1. Vehicles attempting to leave area upon arrival of fire companies 2. Vehicles seen more than once during fire 3. Vehicles damaged by fire, heat, or smoke 4. Note vehicles in driveway and adjacent to incident 5. Record descriptions and license numbers <p>E. Spectators in area of fire</p> <ol style="list-style-type: none"> 1. Groups of spectators should be photographed for later detailed review 2. Groups of spectators should be observed for various reasons <ol style="list-style-type: none"> a) Familiar faces or individuals seen at other fires b) Unusual actions <ol style="list-style-type: none"> 1) Overly brave 2) Overly critical 3) Overly helpful 4) Overly curious 3. Observe manner of spectators' dress and record anything unusual <ol style="list-style-type: none"> a) Does manner of dress fit time of fire? <ol style="list-style-type: none"> 1) Late night or early morning fires usually have spectators/victims who dressed hurriedly 2) Depends on area where fire occurs 3) Depends on amount of time since fire was discovered b) Does manner of dress fit area or neighborhood 4. Appearance of spectators may provide leads <ol style="list-style-type: none"> a) Spectators leaving scene b) Anxiousness 	<p>Why is this information of importance to you as an investigator?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 5. Spectators may show signs of having been involved in starting fire <ul style="list-style-type: none"> a) Fire-damaged clothing b) Fire injuries c) Rescue attempts F. Examine area for evidence of exterior ignition sources <ul style="list-style-type: none"> 1. Evidence of lightning 2. Evidence of fire spreading from outside to inside of structure 3. Determine farthest extension of fire G. Examine area for evidence of incendiarism <ul style="list-style-type: none"> 1. Evidence of use of accelerants 2. Evidence of forcible entry <ul style="list-style-type: none"> a) Confirm entry damage by other than fire department personnel b) Confirm entry damage by other than occupants/neighbors attempting to fight fire or rescue occupants 3. Evidence of individuals having traveled in area (footprints, tire prints, or other evidence of activity) H. Identify utilities <ul style="list-style-type: none"> 1. Where electrical service enters structure and determine if power was on or off upon arrival of fire fighters 2. Where other fuels (i.e., natural gas, LPG, fuel oil, etc.) enter structure <ul style="list-style-type: none"> a) Determine if fuel was on or off upon arrival of fire fighters 	<p>What are some examples?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>VI. EXAMINE INTERIOR OF STRUCTURE</p> <ul style="list-style-type: none">A. Established area of originB. Established cause of fire<ul style="list-style-type: none">1. If accidental<ul style="list-style-type: none">a) Document fire scene, area of origin, and fire cause with a written report, photographs, and a diagramb) If you are a public investigator, do not collect any physical evidence of an accidental fire cause<ul style="list-style-type: none">1) Spoliation of evidence2. If incendiary<ul style="list-style-type: none">a) Continue investigation to determine all facts concerning incidentb) Search for evidence<ul style="list-style-type: none">1) Identify evidence2) Sketch, record, and photograph3) Collect evidenceC. Sketch, measure, and photograph incident scene<ul style="list-style-type: none">1. Point of origin2. Fire cause3. Evidence of accidental or incendiary origin <p>VII. EXAMINE ALL POSSIBLE POINTS OF ENTRY</p> <ul style="list-style-type: none">A. Possibilities<ul style="list-style-type: none">1. Doors2. Windows3. Transoms4. Skylights5. Vents6. Crawl spaces7. Concealed spaces	



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<p>B. Record whether these points of entry were open or closed at time of fire</p> <p>C. Record if forcible entry was made at each point</p> <ol style="list-style-type: none"> 1. If forces confirm entry by fire companies, occupants, or neighbors/spectators 2. Record identity of individual making forced entry 3. Record direction and method of forcible entry <p>D. If forced entry was made in areas not involved in fire, note probable reason for forcing entry</p> <ol style="list-style-type: none"> 1. Search for victims 2. Ventilation of structure 3. Search for fire spread 4. Theft of valuables or other property 5. Crimes committed prior to fire <p>E. Record (note/photograph) all security locks at each possible point of entry</p> <ol style="list-style-type: none"> 1. Type of lock 2. Condition/position on arrival of fire company <p>F. Have areas near possible points of entry examined for latent fingerprints</p> <ol style="list-style-type: none"> 1. Law enforcement should check for fingerprints <p>VIII.INTERVIEWING</p> <p>A. Interview involved persons at the scene</p> <ol style="list-style-type: none"> 1. Obtain personal identifying information <p>NOTE: Some students may feel this is the responsibility of a fire investigator not the origin and cause personnel. Explain such interviews are often essential to origin and cause investigation as well as the other criminal forms of investigation. Details missed early during an investigation may become critical errors later on. Student should treat each investigation the same.</p>	<p>Who should check for fingerprints?</p>



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<ul style="list-style-type: none"> a) Full name b) Date of birth (DOB) c) Home address and telephone number d) Business address and telephone number e) Drivers license number (CDL) <p>B. Person(s) discovering fire</p> <ul style="list-style-type: none"> 1. Each statement should be compared; however, variations will result with respect to time of discovery and location of viewpoints 2. Identify individuals discovering the fire <ul style="list-style-type: none"> a) Nonresident <ul style="list-style-type: none"> 1) Why in the area? 2) Where had individual been? 3) Where was individual going? 3. Questioning should include factors other than fire <ul style="list-style-type: none"> a) Who, other than the individual being questioned, saw the fire? b) What did other people do after discovery of the fire? c) What activities were taking place in the incident area? <ul style="list-style-type: none"> 1) Fights/arguments 2) Loud noises 3) Occupants observed removing property 4. Questioning to be detailed <ul style="list-style-type: none"> a) Location of fire/flames? b) Quantity of smoke present? c) Did anyone leave the building? d) How long before fire companies arrived? <ul style="list-style-type: none"> 1) Remember, civilians often exaggerate 	



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<ul style="list-style-type: none"> 2) Some individuals want city or society to be blamed 3) May confuse flame and smoke C. Person(s) reporting fire <ul style="list-style-type: none"> 1. Many people may report same fire <ul style="list-style-type: none"> a) Identify initial reporting party 2. Interview as many as possible <ul style="list-style-type: none"> a) Especially those individuals making the initial "911" calls 3. Fire department dispatchers may provide tapes and other valuable information D. Witnesses and spectators <ul style="list-style-type: none"> 1. Statements may confirm or contradict stories of involved individuals 2. Witnesses/spectators may report actions of owners/occupants E. Emergency personnel at fire scene <ul style="list-style-type: none"> 1. Fire department personnel <ul style="list-style-type: none"> a) First-arriving companies b) Other fire companies c) Companies performing overhaul <ul style="list-style-type: none"> 1) Returning owners/occupants often converse with last company at the scene 2) Fire personnel may overhear statements/conversations 2. Questioning fire department personnel <ul style="list-style-type: none"> a) Concerning arrival on scene <p>NOTE: Explain that fire personnel are often overlooked.</p> <ul style="list-style-type: none"> 1) Extent and color of smoke 2) Extent and color of flame 3) Who was present 4) People observed at other fires 	



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<ul style="list-style-type: none"> 5) People acting suspicious <ul style="list-style-type: none"> • According to FBI National Center for Violent Crime Studies on serial arsonists, 60%-70% of serial arsonists return to the scene of the crime within the first thirty minutes and 90% of serial arsonists return to the scene within twenty-four hours 6) How were owners/occupants dressed? 7) Equipment or possessions removed 8) Vehicles observed leaving area 9) Which areas of the structure were involved in actual burning b) Concerning entry into structure and fire area <ul style="list-style-type: none"> 1) Windows/door locked 2) Forcible entry used 3) Forcible entry prior to fire company arrival 4) Were contents as they should have been? c) Concerning activities of occupants/owners <ul style="list-style-type: none"> 1) Attempting to fight fire 2) Removing property d) Concerning evidence of incendiarism <ul style="list-style-type: none"> 1) Fire flashbacks 2) Burning on surface of water 3) More than one fire 4) Holes in walls, floors, ceilings, etc. 5) Trailers 6) Accelerant containers 7) Missing contents/equipment 8) Remains of incendiary devices 9) Accelerant odors 	<p>What are some of your personal experiences?</p>



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<p>3. Police department personnel</p> <p>a) Questioning police personnel</p> <p>1) Extent and color of smoke</p> <p>2) Location of flames</p> <p>3) Actions of owners/occupants</p> <p>4) Manner of dress of owners/occupants</p> <p>5) Vehicles observed leaving area</p> <p>b) Police officers working traffic/crowd control at incident scene may have observed actions missed by others</p> <p>c) Area police officers who did not work during fire often have "street information" concerning the incident</p> <p>d) Did they detect accelerant odors on bystanders?</p> <p>4. Other emergency personnel in area may have observed actions/activities missed by others</p> <p>a) EMS personnel</p> <p>b) Utility personnel</p> <p>5. Often necessary to have each individual prepare a written statement; then conduct follow-up interview as needed</p> <p>IX. INCIDENT SCENE INVESTIGATION FOR COMMERCIAL OCCUPANCIES</p> <p>A. Alarms in use are fire, smoke, carbon monoxide, and burglary</p> <p>1. Record time alarm received by fire communication center</p> <p>2. Record time alarm received by fire company</p>	<p>What kinds of questions should you ask police personnel?</p> <p>What are some examples of "other emergency personnel?"</p>



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<ul style="list-style-type: none"> 3. Record time alarm received by private alarm service <ul style="list-style-type: none"> a) Record information concerning private alarm service company <ul style="list-style-type: none"> 1) Closing signal on date of fire 2) Trouble signals or reports of system malfunctions 4. Examine alarm systems for evidence of tempering <ul style="list-style-type: none"> a) Power supply disconnected (AC and/or DC power supplies) b) Bypassed controls and/or switches c) Cut wires d) Alarm relay and/or bell disconnected <ul style="list-style-type: none"> 1) Clapper removed or broken 2) Wires cut 3) Bell (alarm) removed/disabled e) Alarm shut off 5. Surveillance video cameras on scene or in nearby area <ul style="list-style-type: none"> a) Events before and during the fire, including actual ignition and development of the fire may have been recorded B. Note inventory on premises <ul style="list-style-type: none"> 1. Commercial business serving/selling food, beer, wine, and/or liquor <ul style="list-style-type: none"> a) Amount on display compared to amount of like items in stock supplies b) Evidence of incoming supplies <ul style="list-style-type: none"> 1) Receipts/checks 2) List of suppliers 	<p>Why is this documentation necessary?</p>



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<ul style="list-style-type: none"> c) Evidence of sales/customers <ul style="list-style-type: none"> 1) Empty supply containers 2) Dirty/used serving equipment 3) Evidence of cooking and/or food preparation 4) Trash cans in use 5) Ashtrays in use 6) Pencils, pens, pads, etc., present 2. Item to note for all commercial business <ul style="list-style-type: none"> a) Evidence of bad or slow business <ul style="list-style-type: none"> 1) Sale signs 2) Bargain prices 3) Small stock 4) Limited selection b) Type/style of stocked materials <ul style="list-style-type: none"> 1) Out-of-style stock 2) Out-of-date stock 3) Seasonal stock 4) Banned or recalled stock 3. Overall appearance of inventory <ul style="list-style-type: none"> a) Going business b) Dead or dying business 4. Inventory of property may be necessary 5. Evidence or indicators of stock present during the fire <ul style="list-style-type: none"> a) Most items in the fire area on shelves or floor <ul style="list-style-type: none"> 1) Record any indications of stock present during fire 2) Record indicators of removed stock 3) This can be compared to the owners/occupants stated loss 	<p>What are some examples?</p>



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<ul style="list-style-type: none"> b) Impressions (protected areas) may indicate preparations for burning made prior to the fire <ul style="list-style-type: none"> 1) Boxes stacked against door to block entry 2) Boxes stacked to cover windows 3) Boxes stacked to hold open fire doors 6. Inventory to be compared to supplier's records <ul style="list-style-type: none"> a) Compile complete listing of suppliers used by company involved in fire b) Review orders or purchases during period prior to fire (minimum period of one year) C. Cash and/or valuables present <ul style="list-style-type: none"> 1. Are valuables/cash usually left on premises after closing? <ul style="list-style-type: none"> a) Were such items removed on the day or night of the fire? 2. Employees may identify what items were and were not usually left after closing 3. Examples of items, often left during "closed" hours <ul style="list-style-type: none"> a) Petty cash b) Register change c) Guns d) Checkbook 4. Detailed description of cash/valuables found at scene to be recorded <ul style="list-style-type: none"> a) Guns - record serial numbers b) Cash - record exact amounts, denominations, location where found, and probability of fire loss of cash in same area <ul style="list-style-type: none"> 1) Was area actually involved in fire? c) Cash/valuables often exaggerated on stated loss <ul style="list-style-type: none"> 1) Fraudulent claim 	<p>What are some examples?</p>



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<ul style="list-style-type: none"> d) Individual's movements <ul style="list-style-type: none"> 1) Prior to fire 2) At time of fire 3) After fire e) Keys to be checked in lock f) Note any changes in locks <p>D. Utilities</p> <ul style="list-style-type: none"> 1. Utilities off or on <ul style="list-style-type: none"> a) When and why cut off b) Individual causing change in service 2. Utility payment records to be recorded 3. Trouble reports to or from utility company <p>E. Details concerning insurance coverage</p> <ul style="list-style-type: none"> 1. Total amount of fire insurance in force <ul style="list-style-type: none"> a) Name of company b) Amount of coverage <ul style="list-style-type: none"> 1) Policy limits 2) Additional rider c) Policy numbers d) Inception and expiration dates <ul style="list-style-type: none"> 1) Binder in effect prior to the policy being issued e) Last increase and/or decrease (reason for increase/decrease) f) Unique coverage <ul style="list-style-type: none"> 1) Loss payee (tenant purchases insurance and owner is loss payee) 2) Tenant or owner purchase "tenant improvements insurance" with tenant as loss payee 	<p>What type of insurance details should you look for?</p>



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<p>2. Total amount of business interruption insurance</p> <p>3. Insurance agent (broker)</p> <p style="padding-left: 20px;">a) Name</p> <p style="padding-left: 20px;">b) Address</p> <p style="padding-left: 20px;">c) Telephone number</p> <p>X. FIRE SCENE INVESTIGATION FOR RESIDENTIAL OCCUPANCIES</p> <p>A. Alarms (if present)</p> <p style="padding-left: 20px;">1. Check system for damage prior to fire</p> <p>B. General condition of structure</p> <p style="padding-left: 20px;">1. Livable conditions compared with rest of neighborhood</p> <p>C. General repair of structure</p> <p style="padding-left: 20px;">1. Evidence of proper upkeep</p> <p style="padding-left: 20px;">2. Evidence of structure being allowed to rundown</p> <p>D. Structure fully occupied or partially vacant</p> <p>E. Neighborhood in state of change</p> <p style="padding-left: 20px;">1. Many vacant structures</p> <p style="padding-left: 20px;">2. Many structures for sale/lease</p> <p>F. Occupants receiving public assistance</p> <p style="padding-left: 20px;">1. Occupants requesting to move to new quarters</p> <p style="padding-left: 20px;">2. Occupants receiving assistance after fire</p> <p style="padding-left: 40px;">a) Temporary housing</p> <p style="padding-left: 40px;">b) Cash for property replacement</p> <p>G. Pets present, missing, or deceased</p> <p style="padding-left: 20px;">1. Pets which are usually left in the structure but were removed on the day of the fire</p> <p style="padding-left: 20px;">2. Check with neighbors to confirm if pets are usually left in the structure</p> <p style="padding-left: 20px;">3. In some incidents, if a deceased animal is found, a necropsy might be in order</p>	



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<ul style="list-style-type: none">H. Visitors/children present prior to fire<ul style="list-style-type: none">1. Conduct follow-up investigation into backgrounds of individuals2. Record of prior fires3. Problems between visitor and occupantsI. Neighborhood<ul style="list-style-type: none">1. Problems with occupants<ul style="list-style-type: none">a) Fights/argumentsb) Police calledc) Racial problems2. Does structure and/or occupants fit into social level of neighborhoodJ. Insurance information<ul style="list-style-type: none">1. Total amount of fire insurance coverage<ul style="list-style-type: none">a) Name of companyb) Amount of coveragec) Policy numbersd) Inception and expiration dates<ul style="list-style-type: none">1) Binder in effect prior to policy being issuede) Last increase/decreasef) Policy limits/floaters or rider2. Insurance agent (broker)<ul style="list-style-type: none">a) Nameb) Addressc) Telephone number	



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Fire Origin and Cause Determination

Summary:

A multitude of indicators is generally present at a fire scene. Determining that the fire was of an incendiary origin requires the investigator to eliminate all potential accidental causes and pursue all other indicators while reconstructing the occurrences that lead up to the fire.

Evaluation:

The student will complete the summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 5: Basic Fire Science, Pages 921-34 through 921-39, Sections 5.9-5.12, Chapter 6: Fire Patterns, Pages 921-39 through 921-59, Sections 6.1-6.4.1.2, Chapter 7: Building Systems, Pages 921-59 through 921-66, Sections 7.1-7.4.5, Chapter 9: Building Fuel Gas Systems, Pages 921-90 through 921-97, Sections 9.1-9.9.7.2; Chapter 14: Pages 921-118 through 921-120, Sections 14.1-14.4.3; and Annex A, Pages 921-270 and 921-271 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #16: Vehicle Fire Investigation

Time Frame: 2:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #15: Vehicle Fire Investigation

Behavioral Objective:

Condition: Given a formative and summative test

Behavior: The student will describe why most total loss vehicle fires are thought to be arson, indicators which suggest an arson origin, and procedures used to investigate vehicle fires

Standard: With a minimum 80% accuracy on the summative test according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 25: Motor Vehicle Fires, Pages 921-208 through 921-223, Sections 25.1-25.15.2 and Annex A, Pages 921-266 and 921-267 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 109-116

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Fire Investigation Handbook, National Insurance Crime Bureau, 1995
- Investigation of Motor Vehicle Fires, Lee S. Cole, 1992
- NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 25: Motor Vehicle Fires, Pages 921-208 through 921-223, Sections 25.1-25.15.2 and Annex A, Pages 921-266 and 921-267
- Vehicle Fire Investigation, California Conference of Arson Investigators, 1994, Workbook and VHS

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience



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Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. INTRODUCTION</p> <ul style="list-style-type: none">A. Vehicles are often burned for many of the same reasons as are structuresB. Not all experts agree as to the combustibility of modern vehiclesC. There are many physical indicators which help to identify vehicle fire causeD. Newer model vehicles contain modified fuel, propulsion, and exhaust systems which pose new problems for the investigatorE. Investigator safety<ul style="list-style-type: none">1. There are inherent dangers associated with a post fire and/or post accident investigation<ul style="list-style-type: none">a) Supplemental restraint systems<ul style="list-style-type: none">1) Air bags2) Side bags3) Curtain bagsb) Struts<ul style="list-style-type: none">1) Hatchback2) Hood3) Seatc) Bumpers<ul style="list-style-type: none">1) Two-piece front constructiond) Rearview mirror<ul style="list-style-type: none">1) Self-adjusting type<ul style="list-style-type: none">• Toxic gasese) Electrical/battery<ul style="list-style-type: none">1) Extreme high voltage2) Extreme caustic solutions	
<p>II. MOST MODERN VEHICLES ARE DESIGNED TO PROVIDE BASIC SAFETY FROM FIRE</p> <ul style="list-style-type: none">A. Fire safety and vehicle electrical systems	



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<ul style="list-style-type: none"> 1. Overload protection helps limit fire damage 2. Damage from short-circuits is usually limited to wiring between the short and the first line fuse 3. Equipment and accessory short-circuits are usually limited to localized damage B. Fire safety and interior finishes of vehicles <ul style="list-style-type: none"> 1. Fabrics are often flame-retardant 2. Foam padding is often manufactured to resist small ignition and smoldering ignition sources C. Fire safety and the fire loading of vehicles <ul style="list-style-type: none"> 1. Vehicle designs usually provide separation between fuel and ignition sources 2. Overall vehicles pose moderate fire loads <ul style="list-style-type: none"> a) Once ignited the synthetic materials burn intensely and flow as flammable liquids b) Contained atmosphere <ul style="list-style-type: none"> 1) Compartmentalized D. Fire safety and the vehicle exhaust system <ul style="list-style-type: none"> 1. Properly installed and maintained exhaust systems present limited hazard E. Bulkhead <ul style="list-style-type: none"> 1. The bulkhead is the vertical divider between the engine compartment and the passenger compartment. 2. Designed to protect passengers from engine compartment heat 3. Vehicles have one type of bulkhead regardless of the accessories <ul style="list-style-type: none"> a) Manufactured with maximum number of precut holes 	<p>What is the purpose of the vehicle's bulkhead?</p>



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<p>b) For vehicle with few accessories fire can penetrate non-metallic plugs added to seal unused holes</p> <p>III. VEHICLES SUBJECT TO ARSON</p> <p>A. Several pertinent facts relating to vehicle fires</p> <ol style="list-style-type: none"> 1. Ownership of the vehicle in relation to the burning of the vehicle <p>NOTE: Discuss the number of private versus company-owned total loss vehicle fires and form a hypothesis.</p> <ol style="list-style-type: none"> a) Company-owned fleet or public vehicles are seldom involved in incendiary fires <ol style="list-style-type: none"> 1) Exception business failure 2) Business competition b) Privately-owned vehicles are more often involved in incendiary fires <ol style="list-style-type: none"> 2. Financed vehicles are more often involved in incendiary fires than vehicles owned outright 3. Insured vehicles are more often involved in incendiary fires than uninsured vehicles 4. Fire injuries to operators or passengers may indicate arson <ol style="list-style-type: none"> a) Injuries may have been caused by throwing ignitable accelerant onto a burning vehicle b) Stories are often developed by injured operator or passenger to cover arson 5. Time of the fire may relate to a possible arson <ol style="list-style-type: none"> a) Most accidental fires occur while vehicle is being operated b) Most incendiary vehicle fires occur late at night 6. Location of the vehicle is important 	<p>When do most vehicle fires occur?</p>



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<ul style="list-style-type: none"> a) Most incendiary vehicle fires occur on remote roads, back alleys, vacant lots, or in other locations which provide cover b) Do not overlook daytime freeway incidents <ul style="list-style-type: none"> 1) It is very easy to stage an accidental fire and come up with a cover story 7. New vehicles <ul style="list-style-type: none"> a) Contract/financing terms and limits <ul style="list-style-type: none"> 1) Return policy with mileage and/or time limits b) Leasing <ul style="list-style-type: none"> 1) Mileage limit penalties B. Incendiary vehicle fires and crime concealment <ul style="list-style-type: none"> 1. Stolen vehicle <ul style="list-style-type: none"> a) Vehicle stripped and burned 2. Vehicle used in a crime <ul style="list-style-type: none"> a) Vehicle burned to destroy evidence <ul style="list-style-type: none"> 1) Fingerprints 2) DNA evidence 3. Vehicle used as a cover up for a homicide <ul style="list-style-type: none"> a) Human remains can sustain major damage <ul style="list-style-type: none"> 1) May be difficult to identify victim 4. Additional evidence may be in, on, or around the vehicle <ul style="list-style-type: none"> a) Tire marks b) Footprints c) Bullet shell casings d) Weapons e) Accelerant containers <ul style="list-style-type: none"> 1) Gas can 2) Jars and bottles 	



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<p>f) Glass breakage and the location of the glass in relationship to the doors</p> <p>IV. FIRE SCENE EXAMINATION</p> <p>A. Not unlike structure fire investigation procedures</p> <p>B. Must identify point of origin</p> <p>C. Must identify fire cause</p> <ol style="list-style-type: none"> 1. Heat source 2. Fuel source 3. Event <p>D. More than one area of uncommunicated fire damage.</p> <p>E. Work from the area of least to most fire damage</p> <p>F. Survey the surrounding area</p> <ol style="list-style-type: none"> 1. Footprints/tire tracks can place owner at the incident scene <ol style="list-style-type: none"> a) May destroy story of vehicle being stolen and then burned b) May help to identify accomplices c) May indicate direction of retreat 2. Skid marks or absence of skid marks <ol style="list-style-type: none"> a) Sudden fire and a panic stop usually produces skid marks 3. Gas cap missing <ol style="list-style-type: none"> a) Search for missing cap b) Examine the filler neck for damage c) Note and photograph location where found d) Examine for evidence of explosion damage e) Discovery of gas cap may destroy owner or operator story of cover f) Siphon hose may be nearby 	<p>What can the surrounding area tell us about the fire?</p>



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<p>4. Accelerant residues may be recovered from soil under or near vehicle</p> <ul style="list-style-type: none"> a) Accelerant may leak through from vehicle's interior b) Accelerant may be used as a trailer to allow arsonist to start fire some distance from the vehicle c) Accelerant residue may be several inches down into the soil <p>5. Damage to the surrounding area should be noted</p> <ul style="list-style-type: none"> a) May be caused by flammable accelerant on ground <p>6. Accelerant container often recovered in the incident area</p> <ul style="list-style-type: none"> a) Accelerant container may be discarded by throwing into nearby cover or into burning vehicle b) Container may be found inside the vehicle under the fire debris c) Accelerant container may be thrown from vehicle used to transport arsonist after fire was set d) Container impression may be visible on the ground <p>G. Examination of vehicle's exterior</p> <ul style="list-style-type: none"> 1. Collision damage <ul style="list-style-type: none"> a) Note damage b) Check police reports and insurance company reports for record of damage prior to fire 2. Exterior fire damage <ul style="list-style-type: none"> a) Plastic mirrors and exterior ornaments will run and drip appearing to be liquid accelerant 3. Examine tires <ul style="list-style-type: none"> a) Pads will usually remain under vehicle wheels or rims 	



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<ul style="list-style-type: none"> b) Check tires or pads for odd tread or uneven wear which may indicate a change of tires prior to the fire c) Actual condition of tires should be compared to the owner's proof-of-loss statement d) Original tires may be located on owner's or accomplices' property <p>4. Examine wheels – rims</p> <ul style="list-style-type: none"> a) Check for missing lugs which may indicate haste in fire preparations b) Check for mismatched wheels which were changed prior to the fire c) Check for jack impressions in ground around vehicle <p>H. Examination of vehicle's trunk</p> <ul style="list-style-type: none"> 1. Spare tire <ul style="list-style-type: none"> a) New vehicle usually has a new spare tire b) Compare wheel color or check local dealer to determine proper wheel color 2. A car jack should be present <ul style="list-style-type: none"> a) The jack is often found near or under the "stripped" vehicle which may provide fingerprints <p>I. Examination of vehicle's interior</p> <ul style="list-style-type: none"> 1. Accelerant container often left inside vehicle <ul style="list-style-type: none"> a) Arsonist often believes container will be totally consumed b) Most containers leave some evidence such as <ul style="list-style-type: none"> 1) Glass jugs <ul style="list-style-type: none"> • Search for neck and/or carrying ring 2) Plastic jugs <ul style="list-style-type: none"> • Search for melted plastic 3) Metal cans <ul style="list-style-type: none"> • Seldom totally destroyed 	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> c) Discovery of accelerant container may help to destroy cover of story of owner d) Container may provide accelerant comparison sample 2. Combustible material added to inside of vehicle <ul style="list-style-type: none"> a) Often leaves little evidence b) Combustible under seats may survive hose streams 3. Accelerant residue may be recovered from vehicle interior <ul style="list-style-type: none"> a) Accelerant flows to lowest level and may be recovered from <ul style="list-style-type: none"> 1) Floor carpets 2) On or under floor mats 3) In metal floor indentations 4) Around rubber grommets 4. Vehicle seat cushions <ul style="list-style-type: none"> a) Certain types of foam rubber, poly foam or foamed plastics may be ignited readily by an open flame <ul style="list-style-type: none"> 1) Once ignited, these materials often produce large amounts of smoke and high heat 5. Position and condition of vehicle's windows <ul style="list-style-type: none"> a) Open windows during very cold weather not normal b) Fire may self-extinguish if windows are left closed c) If glass melted, check window's regulators to determine position of windows at the time of the fire d) Melted window glass indicates a hot fire but does not prove the fire to be arson 6. Position of vehicle's doors <ul style="list-style-type: none"> a) Vehicle's doors are often left open when the vehicle is intentionally burned 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

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<ul style="list-style-type: none"> b) Damage to vehicle's doors may indicate their positions during the fire 7. Steering lock assembly <ul style="list-style-type: none"> a) May discredit story of stolen vehicle b) May require examination by expert locksmith to determine if assembly has been damaged <ul style="list-style-type: none"> 1) The brass key wafers may have a tool mark on them if they have been forced 2) If the brass key wafers were intact, it means that a key was used 8. Evidence of attempts to extinguish the fire should be noted <ul style="list-style-type: none"> a) Evidence of sand, dirt, or extinguishing agents can often be found in the vehicle's interior b) May confirm or contradict owner's story 9. Examination of debris in vehicle's interior <ul style="list-style-type: none"> a) Ignition key <ul style="list-style-type: none"> 1) The significance of just finding the ignition key inside or near the vehicle is that 80%-90% of people have more than one key on their key ring <p>NOTE: Have students pull their key rings out; allow further discussion.</p> <ul style="list-style-type: none"> 2) Key may fall to floor when ignition switch melts with brass key wafers surrounding the key b) Personal items c) Evidence or the remains or incendiary devices may be recovered from vehicle's interior 10. Examine vehicle's glove compartment <ul style="list-style-type: none"> a) An empty glove compartment is usually considered to be suspicious 	<p>What is the significance of finding just the ignition key?</p>



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Fire Origin and Cause Determination

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<ul style="list-style-type: none"> b) Glove compartments may contain copies of the vehicle's repair record and may help to identify prior mechanical problems <p>11. Examine vehicle's interior for evidence of accessories having been removed</p> <ul style="list-style-type: none"> a) Owner often removes accessories for later use b) Owner may remove accessories to give or sell to accomplices, relatives, or friends c) Some vehicle accessories may not totally burn or melt d) Most vehicle accessories will leave metal mount holes or brackets e) Empty mounting brackets or holes should be considered as suspicious f) Serial numbers and physical descriptions of all accessories should be recorded for later comparison to the insured's proof-of-loss statement <p>J. Examination of vehicle's fuel system</p> <p>1. Examine tank fill cap and spout</p> <ul style="list-style-type: none"> a) Often removed to allow siphoning of fuel <ul style="list-style-type: none"> 1) Cap may be discarded by throwing 2) Into nearby groundcover 3) Inside vehicle b) Along road as arsonist leaves area c) Owner may claim explosion of fuel tank blew cap off <ul style="list-style-type: none"> 1) Check for damage to cap flanges 2) Check for damages to filler spout 3) Check fuel tank for damage 	<p>What types of materials are usually found inside glove compartments?</p>



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>2. Examine fuel lines and/or fuel rails</p> <ol style="list-style-type: none"> a) Connections may be loosened or fuel lines may be cut b) Check for evidence of tampering or recent tool marks <p>K. Examination of vehicle's engine compartment</p> <p>NOTE: Many of the following indicators not only help to identify point of origin but suggest fire cause.</p> <ol style="list-style-type: none"> 1. Evidence of attempts to extinguish fire <ol style="list-style-type: none"> a) Check for dirt, sand, or extinguishing agents b) Compare to owner's story 2. Examine motor supports 3. Examine radiator 4. Examine fan, generator, and air conditioner belts 5. Check for missing accessories <ol style="list-style-type: none"> a) Battery, carburetor, generator, starter, etc., are not totally destroyed 6. Examine the fuel system 7. Examine fuel pump and fuel line 8. Examine additional engine accessories <ol style="list-style-type: none"> a) Turbochargers <ol style="list-style-type: none"> 1) Adds power to the output of the engine by increasing the amount of air into the cylinders 2) Turbocharger and the adjacent exhaust manifold are the hottest external parts on the engine <ul style="list-style-type: none"> • Combustibles in contact can be easily ignited • Failure can be a lack of maintenance <ul style="list-style-type: none"> Lack of oil lubrication Contaminated lubricate Foreign object into turbine 	



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<p>L. Examination of vehicle's engine and drive train</p> <ol style="list-style-type: none">1. Engine<ol style="list-style-type: none">a) Check for damage to engine, such as holes in block, cracked head, etc.b) Check for missing or loose head boltsc) Check for missing or loose oil pan bolts or screws2. Drive train<ol style="list-style-type: none">a) Check for lubricant leaks which may identify possible mechanical problemsb) Check drive train<ol style="list-style-type: none">1) Parts of drive train may be missing2) Drive shaft may not be connected3. Mechanical examination of engine and drive train<ol style="list-style-type: none">a) May require services of an expert mechanicb) Attempt to start and run enginec) Disassemble and examine engine, transmission, etc.d) Compression and Leak down tests <p>M. Examination of vehicle's electrical systems</p> <ol style="list-style-type: none">1. Missing battery can eliminate electrical fire cause2. Examine fuses and fusible links<ol style="list-style-type: none">a) Modern vehicles are well-protected from selected short circuits and current overloads and most accidental fires result in local damage onlyb) All fuses and fusible links to be examined and notedc) Local dealership may provide assistance3. Examine power distribution center4. Examine battery<ol style="list-style-type: none">a) Battery may drain rapidly when short circuit occurs in primary circuit	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 1) Battery which remains charged probably not involved in short circuit in primary wiring <ul style="list-style-type: none"> • Primary wiring leads from battery to ignition switch and to coil • This is energized at all times 2) Check battery with tester b) Hybrid vehicles <ul style="list-style-type: none"> 1) High voltage system may be energized <ul style="list-style-type: none"> • Up to 600 volts 2) Make sure manual disconnect switch is disengaged before examining any electrical components 5. Check all fluid levels <ul style="list-style-type: none"> a) Every fluid in the engine compartment can be a fuel source for a fire <ul style="list-style-type: none"> 1) Windshield washer fluid 2) Antifreeze 3) Fuel <ul style="list-style-type: none"> • Gasoline • Diesel 4) Power steering fluid 5) Brake fluid 6) Engine oil 7) Transmission fluid b) Fluid analysis <ul style="list-style-type: none"> 1) Engine oil sample <ul style="list-style-type: none"> • Wear and tear on internal engine components • Water in the oil 2) Transmission fluid sample 3) Independent laboratory testing is available for engine and transmission fluid analysis 	



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PRESENTATION	APPLICATION
<p>N. Vehicle's supplemental restraint system</p> <ol style="list-style-type: none">1. Undeployed airbags<ol style="list-style-type: none">a) Sodium azide is the propellant used in an air bag<ol style="list-style-type: none">1) Inhalation after a fire is a hazard2. Air bags can deploy without warning3. Multiple locations within the vehicle<ol style="list-style-type: none">a) Side curtainsb) Rolloverc) Window curtainsd) Under the dashboarde) Steering wheel <p>V. ACCOMPLICES AND WITNESSES</p> <p>A. Accomplices</p> <ol style="list-style-type: none">1. Individuals will usually report a vehicle stolen after a friend has driven them back to town<ol style="list-style-type: none">a) Check police reports and compare time reported stolen with time fire reported2. Vehicles are burned in areas providing cover<ol style="list-style-type: none">a) Arsonist must have some way backb) Question owner as to why they were in the area<ol style="list-style-type: none">1) Request local law enforcement to immediately respond to registered owners address if owner is not at scene3. Accomplices may help to burn vehicle or provide transportation4. Vehicle reported stolen at or near time fire was reported should be considered suspicious <p>B. Witnesses</p> <ol style="list-style-type: none">1. Someone somewhere<ol style="list-style-type: none">a) Saw somethingb) Heard somethingc) Knows something	



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<ul style="list-style-type: none"> 2. Vehicle fires are usually witnessed or discovered prior to self-extinguishment 3. Check nearest neighbors to fire scene <ul style="list-style-type: none"> a) May have heard voices b) May have noticed the period of time between the stopping of the car and discovery of the fire <p>VI. VEHICLE FIRES OTHER THAN AUTOMOBILES</p> <ul style="list-style-type: none"> A. Pleasure craft and recreational vehicles <ul style="list-style-type: none"> 1. Fiberglass construction may add to fire load and fire damage 2. Added hazards <ul style="list-style-type: none"> a) Cooking b) Additional electrical circuits c) Vapor build-up or bilge areas 3. Added fuels <ul style="list-style-type: none"> a) LP b) Heaters c) Lanterns d) Generators B. Trucks <ul style="list-style-type: none"> 1. A lesser amount of combustibles in the engine compartment <ul style="list-style-type: none"> a) Plastics C. Heavy equipment <ul style="list-style-type: none"> 1. Has a variety of hydraulic systems for lifting, moving, and transmissions <p>VII. OWNERSHIP AND VEHICLE REGISTRATION NUMBERS</p> <ul style="list-style-type: none"> A. Vehicle identification numbers (VIN) <ul style="list-style-type: none"> 1. Prior to 1969 <ul style="list-style-type: none"> a) There were no standards for VIN locations 	<p>Is this information routinely obtained today?</p>



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Fire Origin and Cause Determination

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<p>b) Contact police department auto theft division c) Contact local dealership</p> <p>2. 1969 and later, numbers located on left side of dash</p> <p>a) Visible from outside vehicle b) Also found in other locations</p> <p> 1) Numbers found on door edge or door jamb</p> <ul style="list-style-type: none"> • May be warranty number • May not be VIN • EPA and VIN numbers should match <p>B. Compare VIN to insurance policy</p> <p> 1. Burned vehicle may not be the insured vehicle</p> <p>C. Altered or missing VINs</p> <p> 1. Indicators of tampering</p> <p> a) Grind, file or sand marks b) Overstamps c) Plastic replacement numbers d) Non-OEM or wrong rivets</p> <p>D. Law enforcement assistance</p> <p> 1. Whenever inconsistencies are identified or arson is suspected, contact local law enforcement</p> <p> 2. Law enforcement completes mandates reports for recovered stolen vehicles</p> <p> 3. National Insurance Crime Bureau (NICB)</p> <p> a) VIN Assist</p> <p>VIII.MOTIVES AND VEHICLE INCENDIARISM</p> <p>A. Several unique motives</p> <p> 1. Mechanical problems or failure</p> <p> a) "Lemon"</p>	<p>Why should VIN be compared to insurance information?</p>



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. Financial problems 3. Family problems <ul style="list-style-type: none"> a) Divorce or jealousy 4. Spite or revenge <p>IX. NEW VEHICLE EMISSION CONTROL AND FUEL SYSTEMS</p> <ul style="list-style-type: none"> A. Since 1970, there has been vehicle emission controls and fuel system vapor controls on vehicles B. Vehicle emission control system <ul style="list-style-type: none"> 1. Uses catalytic converters to convert hydrocarbons and carbon monoxide to safer compound 2. Converter construction and operation <ul style="list-style-type: none"> a) Usually covered by stainless steel shell b) Contains clay-like compounds which are treated to react with hydrocarbon emissions c) Converters have very large interior surface areas d) When operating, catalytic converters generate a surface temperature in the range of 600°F-1000°F e) Internal parts may look like small ceramic pellets or "BBs" or a ceramic honeycomb shaped material <ul style="list-style-type: none"> 1) During failure the material is expelled out the exhaust at very high temperature f) Fire dangers from converters <ul style="list-style-type: none"> 1) Undercoating near converters 2) Combustible materials adjacent to converter 3) Dry grass in and around the converter g) If engine is not operating properly, the converter may reach temperatures over 1000°F and may cause ignition of nearby combustibles 	<p>What fire danger is there from converters?</p>



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Fire Origin and Cause Determination

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<ul style="list-style-type: none">C. Fuel vapor systems<ul style="list-style-type: none">1. New vehicles sold in California are not allowed to let fuel vapors escape from the tank2. Newer designs use closed fuel systems<ul style="list-style-type: none">a) Recirculates vaporb) Vapor collected for later burning by vehicle enginec) Fuel tanks not vented through filler cap3. Fire hazards<ul style="list-style-type: none">a) May allow pressure build-upb) Expelled vapor fumes at tank filler may ignite from static electricityD. Vehicle background information<ul style="list-style-type: none">1. Past mechanical problems or repair history can be pertinent to the investigation2. Contact local dealer or manufacturer about recalls or known defects	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

The investigation of vehicle fires is similar to structure fires. An organized, systematic investigation of every fire will assist in identifying the burn pattern indicators which may point to an area of origin.

Evaluation:

The student will complete the summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 25: Motor Vehicle Fires, Pages 921-208 through 921-223, Sections 25.1-25.15.2 and Annex A, Pages 921-266 and 921-267 and Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 109-116 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

- Topic:** #17: Wildland Fire Investigation
- Time Frame:** 2:00
- Level of Instruction:** Level II
- Authority:** 2009 Fire Investigator CTS #16: Wildland Fire Investigation
- Behavioral Objective:**
- Condition:** Given an activity and summative test
- Behavior:** The student will describe wildland fire investigation, including wildland fire causes, environmental effects of fire behavior and point of origin, wildland fire indicators, and the contrast between a wildland fire scene investigation and a follow-up investigation
- Standard:** With a minimum 80% accuracy on the summative test according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 26: Wildfire Investigation, Pages 921-223 through 921-234, Sections 26.1-26.10, and Annex A, Page 921-263, Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 117-133 and successfully completing Individual Activity 17-1
- Materials Needed:**
- Conference board/pads with markers/erasers
 - Appropriate audiovisual training aids and devices
 - Individual Activity 17-1: What Do You See?
- References:**
- Fireline Handbook – Appendix B, NWCG, 2006 Edition, Pages B16-B22, B54-B55
 - Investigation of Wildfires, Richard T. Ford, 1995 Edition
 - NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 26: Wildfire Investigation, Pages 921-223 through 921-234, Sections 26.1-26.10, and Annex A, Page 921-263
 - Wildfire Origin and Cause Determination Handbook, NWCG, 2005 Edition, Pages 7-31 and 50
- Preparation:** Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Attention (attract)
Curiosity (arouse)
Interest (create)
Desire (stimulate)

Begin
Association
Students
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. WILDLAND ENVIRONMENTAL IGNITION FACTORS</p> <p>A. Weather</p> <ol style="list-style-type: none"> 1. Levels of relative humidity <p>B. Fuels</p> <ol style="list-style-type: none"> 1. Size 2. Nature of the fuels 3. Fuel moisture content 4. Density 5. Arrangements 6. Temperature <p>C. Topography</p> <p>II. WILDLAND FIRE SPREAD FACTORS</p> <p>A. Weather is the most changeable factor</p> <ol style="list-style-type: none"> 1. Wind <ol style="list-style-type: none"> a) Greatly affects the speed at which a fire will spread b) Assists in drying out vegetation <ol style="list-style-type: none"> 1) Increasing the ease of ignition c) Creates airborne firebrands, carried aloft by the heated convective air column d) Provides oxygen 2. Temperature of the ambient air <ol style="list-style-type: none"> a) Directly influences the temperature of the fuel <ol style="list-style-type: none"> 1) The sun is one factor that affects temperature 3. Relative humidity <ol style="list-style-type: none"> a) Humidity is the measure of water vapor suspended in air 	<p>What environmental factors influence wildland fire ignition?</p>



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<ul style="list-style-type: none"> b) Relative humidity is the ratio of the amount of moisture in the air to the amount that known volume of air can hold, expressed as a percentage c) The moisture in the air directly affects the amount of fuel moisture and vice versa d) Fine fuels are more responsive to relative humidity than are large fuels e) The moisture may slow the rate of spread of a fire in progress <p>B. Fuel type and characteristics</p> <ul style="list-style-type: none"> 1. Second greatest influence on the rate of fire spread 2. Arrangement <ul style="list-style-type: none"> a) Forest fuels are varied and complex b) Fuel body is subdivided into two broad classes <ul style="list-style-type: none"> 1) Ground fuels 2) Aerial fuels c) Each class is evaluated according to <ul style="list-style-type: none"> 1) Arrangement 2) Compactness 3) Continuity 4) Volume 5) Moisture content 3. Density or sparseness of the fuel cover <ul style="list-style-type: none"> a) Basic factor in fire propagation b) Sparse fuels <ul style="list-style-type: none"> 1) May be too widely spaced for the fire to preheat neighboring fuels to their ignition temperature 	<p>How do fuel characteristics affect fire spread?</p>



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<ul style="list-style-type: none"> c) Dense fuels <ul style="list-style-type: none"> 1) Increase fire intensity 2) Extend flame lengths 3) Accelerate fire spread 4. Fuel size <ul style="list-style-type: none"> a) A major factor governing the ignitibility and burning rate of a fuel is its size b) The smaller the fuel element (surface area-to-mass ratio), the easier it will be to ignite and the faster it will be consumed c) Most often, it requires burning light fuels to serve as kindling to ignite the heavier fuels 5. Fuel moisture content <ul style="list-style-type: none"> a) The amount of moisture present in the fuel plays a major role in determining the rate of spread b) As the vegetation (fuel) dries out, it becomes more readily ignitable and will burn with greater intensity C. Topography <ul style="list-style-type: none"> 1. Relates to the form of earth surfaces 2. Slope <ul style="list-style-type: none"> a) Has a resounding effect on fire spread b) Slope of an area is determined by measuring the rise over run, or the change in elevation over a given distance <ul style="list-style-type: none"> 1) Often expressed as top third, middle third, and bottom third c) Allows the fuel on the uphill side to be preheated more rapidly d) May also result in burning logs and embers rolling down, the hill, starting spot fires below the primary fire 	<p>How does topography affect fire spread?</p>



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<p>e) Aspect of slope</p> <ol style="list-style-type: none"> 1) The direction in which the slope faces 2) Slopes facing the sun are typically drier <ul style="list-style-type: none"> • May have a more combustible fuel <p>III. GENERAL FIRE DIRECTION INDICATORS</p> <p>A. As with structure fire investigation, no one indicator will identify origin and cause of a wildland fire</p> <ol style="list-style-type: none"> 1. Several indicators must be identified and used to trace fire travel back to the point of origin <p>B. Fire progression</p> <ol style="list-style-type: none"> 1. Origins <ol style="list-style-type: none"> a) Backing out b) 360° circle c) Acted on by outside influence <ol style="list-style-type: none"> 1) Natural 2) Artificial 2. Advancing fire <ol style="list-style-type: none"> a) Head 3. Backing fire <ol style="list-style-type: none"> a) Heel 4. Lateral fire <ol style="list-style-type: none"> a) Flanks 5. Macroscale indicators <ol style="list-style-type: none"> a) Large <ol style="list-style-type: none"> 1) Seen from a distance 2) Overall pattern 3) General to advancing fire 	<p>What are some differences between macro- and microscale indicator?</p>



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Fire Origin and Cause Determination

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<ul style="list-style-type: none"> 6. Microscale indicators <ul style="list-style-type: none"> a) Small <ul style="list-style-type: none"> 1) Individual 2) Not easily seen 3) Critical closer to origin 7. Damage differential (degree of damage) <ul style="list-style-type: none"> a) Underlying principle b) Changes that occur with fire interaction c) Dependent on <ul style="list-style-type: none"> 1) Type of object 2) Intensity of heat 3) Length of heat exposure 8. Pattern clusters <ul style="list-style-type: none"> a) Multiple indicators with similar burn vector pattern b) Most reliable in an area <p>IV. SPECIFIC INDICATOR CATEGORIES</p> <ul style="list-style-type: none"> A. Not all indicators will be present on a fire scene B. An investigator's task is to identify as many indicators as possible to find the fire's origin <ul style="list-style-type: none"> 1. Protection indicators <ul style="list-style-type: none"> a) The fire will cause more damage on the side of the object nearest the approaching fire b) On both combustibles and noncombustibles c) Exposed side burned <ul style="list-style-type: none"> 1) Clean 2) More d) Unexposed (protected) side burned <ul style="list-style-type: none"> 1) Ragged 2) Less 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>2. Grass stem indicators</p> <p>a) Backing fire</p> <ol style="list-style-type: none"> 1) The effects of heat will weaken the grass stems at their base <ul style="list-style-type: none"> • The grass stems and heads will fall toward the direction the fire came from • Some may be unburned <p>b) Advancing fire</p> <ol style="list-style-type: none"> 1) As the fire travels upslope or with the wind <ul style="list-style-type: none"> • The flame will burn grass tops first • Stem base left • Can produce protection pattern <p>3. Foliage freeze indicators</p> <p>a) When leaves and small branches are heated they are blown in the direction of the wind as the moisture is driven out of the vegetation, it is "frozen" in place</p> <ol style="list-style-type: none"> 1) After the fire passes the leaves and stems will often remain in a position indicating wind direction for weeks or even months 2) Foliage points the way the fire went <p>4. Damage differential (degree of damage) indicators</p> <ol style="list-style-type: none"> a) Fire-related destruction b) Compare to unburned side c) Closely related to "protection" <p>5. Depth of char indicators</p> <ol style="list-style-type: none"> a) Similar to structural fires b) Mostly associated with finished lumber products <ol style="list-style-type: none"> 1) Fence posts 2) Poles 	<p>What is the significance of grass stem indicators?</p>



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>6. Angle of char indicators</p> <ul style="list-style-type: none">a) Also called vertical charb) Dependent on directional vectors<ul style="list-style-type: none">1) Wind2) Slopec) Wind vector<ul style="list-style-type: none">1) With wind<ul style="list-style-type: none">• Char is higher on leeward side of trunk steeper than slope• Crown damage is greater on leeward side2) Against the wind<ul style="list-style-type: none">• Char is parallel with the groundd) Slope vector<ul style="list-style-type: none">1) Usually a fire moving uphill past a tree will produce char patterns steeper than the slope of the hill and higher on the side away from the approaching fire2) A fire moving downhill past a tree will produce char patterns on the trunk parallel to the slope of the hille) Uphill debris at the base of the tree can alter burn patterns<ul style="list-style-type: none">1) Evaluate quantity of debris and possible effect <p>7. Spalling indicators</p> <ul style="list-style-type: none">a) Generally associated with advancing fireb) Typically not a good directional indicator <p>8. Curling indicators</p> <ul style="list-style-type: none">a) Generally a backing indicatorb) Microscalec) Similar to foliage freeze	<p>What does the angle of char indicator tell?</p>



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<ul style="list-style-type: none"> c) Limbs on opposite side will likely have a pointed appearance d) This effect can occur in grass, and be identified through close examination <ul style="list-style-type: none"> 1) Use the back side of the hand and rub the tops of the stems 2) When moving in the direction of fire travel, there will be a velvety feel 3) When moving in the direction the fire approached, there will be a prickling feeling or resistance 4) The hand should be removed in all directions for best results 5) Several areas should be examined in this manner <p>13. V pattern indicators</p> <ul style="list-style-type: none"> a) Overall shape of the fire perimeter b) Based on basic principle of fire spread c) Origin is likely in the base of the V d) Best visualized by an aerial view <p>14. Die-out pattern indicators</p> <ul style="list-style-type: none"> a) Commonly associated with a backing fire b) Fuels with greater fuel moisture c) High potential for error to identify as origin <p>V. WILDLAND FIRE CAUSES</p> <p>A. Fire cause terminology</p> <ol style="list-style-type: none"> 1. Competent ignition source <ul style="list-style-type: none"> a) The source of heat that kindles a wildland fire 	<p>CLASS ACTIVITY: Complete Group Activity 17-1.</p>



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<ul style="list-style-type: none"> b) May be in the form of a mechanical or electrical spark, glowing ember, open flame, chemical reaction, or friction 2. Ignition factor <ul style="list-style-type: none"> a) Existing conditions and subsequent actions and sequence of events that bring a competent ignition source into contact with the materials first ignited b) The cause of the fire B. The National Wildfire Coordinating Group (NWCG) identifies eight (8) specific fire cause categories <ul style="list-style-type: none"> 1. Local agencies may add to or subtract from this list for various reasons <ul style="list-style-type: none"> a) A mower caused fire may be a subheading under Equipment Use C. A ninth category, Miscellaneous, includes all causes not otherwise identified D. Specific fire cause categories <ul style="list-style-type: none"> 1. Lightning <ul style="list-style-type: none"> a) Positive and negative charged strokes <ul style="list-style-type: none"> 1) 10% are positive 2) 90% are negative 3) Positive strokes have a greater potential to start a fire b) Indicators <ul style="list-style-type: none"> 1) Recent thunderstorms in the area 2) Splitting of trees and poles 3) Discoloration of the ground 4) May strike power or phone lines and cause overloading of protective devices 5) May travel along fences 6) Fulgurites 	



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Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 4) Ambient temperature 5) 30% of glowing tip <ul style="list-style-type: none"> • Length of contact 6) Cigarette remains <ul style="list-style-type: none"> • Square tip • Round tip • Exploded appearance 4. Debris burning <ul style="list-style-type: none"> a) Dumpsites or residential garbage <ul style="list-style-type: none"> 1) Trash piles b) Control burning <ul style="list-style-type: none"> 1) Weed abatement 2) Agricultural waste (stubble) 3) Vegetation management c) Holdover brush fires d) May be similar to campfires 5. Incendiary (arson) <ul style="list-style-type: none"> a) Many of the same devices used to ignite structure fires can be and are used to ignite wildland fires <ul style="list-style-type: none"> 1) Flammable liquids used to accelerate fire spread 2) Road flares 3) Matches and lighters 4) Combinations of cigarettes and match devices 5) Fireworks 6) Magnifying glasses 7) Glowing briquettes 	<p>How is debris burning a problem in your area?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>Carbon-exhaust particles, which may be collected with a magnet</p> <p>Vehicle accidents</p> <p>7. Railroad</p> <ul style="list-style-type: none"> a) All fires from railroad operations, personnel, and rolling stock <ul style="list-style-type: none"> 1) Can include track and right-of-way maintenance b) May have multiple starts along an active line c) Multiple sources of ignition from the locomotive and attached railcars <ul style="list-style-type: none"> 1) Broken brake shoes 2) Exhaust 3) Bearings <p>8. Children</p> <ul style="list-style-type: none"> a) Playing with fire <ul style="list-style-type: none"> 1) Usually due to curiosity 2) Up to 12 years of age b) Secret play area near <ul style="list-style-type: none"> 1) Homes 2) Schools 3) Playgrounds <p>9. Miscellaneous</p> <ul style="list-style-type: none"> a) Wildland fires that cannot be properly classified under other standard causes b) Power lines <ul style="list-style-type: none"> 1) Intact or down 2) Fuses and/or transformers 3) Birds and other animals 4) High winds 	<p>At what age does child curiosity typically stop?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> c) Fireworks <ul style="list-style-type: none"> 1) Presence of spent fireworks 2) Packaging in the area of origin 3) Time of year when fireworks would be used d) Cutting, welding, and grinding <ul style="list-style-type: none"> 1) Industrial operations 2) Residential areas 3) Lack of clearance e) Firearms use <ul style="list-style-type: none"> 1) Powder discharge 2) Bullet types 3) Exploding targets 4) Firearm ranges 5) Expelled burning powder or hot bullet landing in dry vegetation can start a wildland fire f) Blasting <ul style="list-style-type: none"> 1) Area of explosive activity 2) Associated with debris from the blast g) Electric fences <ul style="list-style-type: none"> 1) Weed clippers 2) Domestic animal fencing 3) Charred vegetation transferred to electric wire h) Structures <ul style="list-style-type: none"> 1) Wildland fire occurs from a structure fire i) Flares <ul style="list-style-type: none"> 1) Commercial or industrial activities 2) Vehicle accidents 3) Flare debris 	<p>How does the discharge of firearms cause a wildland fire?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2. Personnel and equipment destroy indicators <ul style="list-style-type: none"> a) Time tends to obscure visual signs as well as to create misleading indicators 3. Record environmental conditions <ul style="list-style-type: none"> a) Fire behavior b) Weather c) Fuels d) Topography B. Determine the area of origin <ul style="list-style-type: none"> 1. If the identified area of origin is very small, the area can be searched in its entirety from its perimeter 2. If the area is large, the site should be broken down into segments for a systematic close-up examination <ul style="list-style-type: none"> a) Loop technique <ul style="list-style-type: none"> 1) Also referred to as the spiral method 2) Effective in a small area 3) As the loop or circle widens, evidence can be more easily overlooked, or even damaged b) Grid technique <ul style="list-style-type: none"> 1) One of the best procedures for covering a large area with more than one searcher 2) The searchers move parallel to one another and cover the same area twice c) Lane technique <ul style="list-style-type: none"> 1) Also referred to as the strip method 2) Can be used effectively if the area to be covered is large and open 3) Relatively quick and simple to implement and may even be performed by a single investigator in small areas 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>3. Identify indicators and work backwards to identify the fire's area of origin</p> <p>4. Rope or flag the area of origin</p> <ul style="list-style-type: none"> a) Protect the area b) Post guard(s) c) Keep people and equipment out of the area <ul style="list-style-type: none"> 1) Includes fire-fighting personnel d) Extreme care must be exercised to avoid trampling of scene <p>C. Determine fire cause and collect evidence</p> <p>1. Identify human and/or animal travel in the area</p> <ul style="list-style-type: none"> a) Photograph all footprints and tire tracks b) Make casts of prints and tracks <p>2. Evidence of accidental fire cause</p> <ul style="list-style-type: none"> a) Remains of cigarettes or matches <ul style="list-style-type: none"> 1) Accidental or arson b) Campfires near point of origin c) Evidence of damage from lightning d) Evidence that sparks from vehicles or power equipment could have caused ignition e) Evidence of attempts to extinguish fire f) Firearms <ul style="list-style-type: none"> 1) Spent shell casings 2) Shell wadding 3) Recovered projectiles 4) Point of impact 	<p>Which search technique was described as the best for large areas?</p> <p>Why do we do this?</p> <p>Why do you need to identify who or what has been in the area?</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 4) Work the shovel or trowel into the dirt, under the object, until the clod of dirt and ash with object has been freed 5) Slide sheet metal under it and lift the clod intact 6) Place the metal and clod into a cotton padded container of appropriate size 7) Seal, mark, and hand carry to lab 8) Clean tools with approved cleaning materials between each collection b) Use the proper container and evidence tag c) Photograph all evidence in place before moving d) Sketch the area and locate where any evidence was found <p>VII. FATAL FIRE IN WILDLAND FIRE SETTING</p> <ul style="list-style-type: none"> A. Secure the area <ul style="list-style-type: none"> 1. At least 200 feet by 200 feet 2. Create single entry point <ul style="list-style-type: none"> a) Limit access b) Authorized investigative personnel only 3. Establish scene log <ul style="list-style-type: none"> a) Entry/exit b) Times in/out c) Name B. Make appropriate notifications <ul style="list-style-type: none"> 1. Law enforcement agencies 2. Coroner's Office/Medical Examiner C. Photograph the entire scene <ul style="list-style-type: none"> 1. Avoid contamination of scene 2. Orientation photos for geographical directions and landmarks 3. Relationship photos of body to possible evidence 4. Identify and secure evidence in place 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>D. Protect the body</p> <ul style="list-style-type: none">1. Protect from the elements<ul style="list-style-type: none">a) Animalsb) Birds2. Cover with tarp, blanket, or other covering <p>VIII. ASSISTANCE FROM OTHER AGENCIES</p> <ul style="list-style-type: none">A. U.S. Forest ServiceB. California Department of Forestry and Fire Protection (CAL FIRE)	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

Wildland fires generally occur for the same reasons as fires in vehicles or structures. Whether accidental or arson, these types of fires provide the fire investigator with a number of different origin and cause factors that require special attention. The unique relationship between fuels, weather, and topography and fire behavior must be clearly understood by the investigator during every phase of these types of investigations.

Evaluation:

The student will complete the activity and summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 26: Wildfire Investigation, Pages 921-223 through 921-234, Sections 26.1-26.10, and Annex A, Page 921-263, Fire Investigation 1A Student Supplement, SFT, 2011 Edition, Pages 117-133 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Group Activity 17-1: What do you see?

Time Frame: 0:15

- Materials Needed:**
- Slides of wildland fire scene with various burn indicators
 - Projector and screen
 - Pen or pencil
 - Paper

Introduction: This activity provides the students the opportunity to review wildland fire burn indicators and determine direction of travel.

- Directions:**
1. Review the slide.
 2. Identify and record any specific indicators you find in each scene.
 3. Determine and record the direction of fire spread.
 4. You have approximately 1 minute per slide to complete this activity.
 5. Be prepared to discuss your answers with the class.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Topic: #18: Explosion Investigation

Time Frame: 2:00

Level of Instruction: Level II

Authority: 2009 Fire Investigator CTS #17: Explosion Investigation

Behavioral Objective:

Condition: Given a summative test

Behavior: The student will describe explosion investigation, including the definition of an explosion, the two types of explosions, the difference between a deflagration and detonation and high-order and low-order explosion

Standard: With a minimum 80% accuracy on the summative test according to the information contained in NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 9: Building Fuel Gas Systems, Page 921-91, Sections 9.2.4-9.2.4.3 and Chapter 21: Explosions, Pages 921-168 through 921-184, Sections 21.1-21.17.6

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Kirk's Fire Investigation, John DeHaan, Pearson Prentice Hall, 2006, Sixth Edition, Pages 448-450
- NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 9: Building Fuel Gas Systems, Page 921-91, Sections 9.2.4-9.2.4.3 and Chapter 21: Explosions, Pages 921-168 through 921-184, Sections 21.1-21.17.6

Preparation:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	Begin
Curiosity (arouse)	Association
Interest (create)	Students
Desire (stimulate)	Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>I. EXPLOSION DEFINED</p> <ul style="list-style-type: none">A. The extremely rapid and violent expansion of gases usually accompanied by the release of energy in the form of heat, light and noiseB. Explosions must be gas dynamic <p>II. NATURE OF EXPLOSIONS</p> <ul style="list-style-type: none">A. Deflagration explosion (rapid burning)<ul style="list-style-type: none">1. Rapid combustion2. Burning rate less than 3,300 feet per second3. Low explosives/burning explosives<ul style="list-style-type: none">a) Black powderb) Smokeless powderc) Flash powderd) Improvised chemical mixturesB. Detonation (explosion)<ul style="list-style-type: none">1. Burning rate 3,300 feet per second or more2. Shock front3. High explosives<ul style="list-style-type: none">a) Detonating explosives<ul style="list-style-type: none">1) Dynamite2) Detonating cord3) TNT4) Ammonium nitrate and fuel oil (ANFO) <p>III. BASIC TYPES OF EXPLOSIONS</p> <ul style="list-style-type: none">A. Mechanical explosion<ul style="list-style-type: none">1. The violent release of pressure from a confined space when the internal pressure overcomes the resistance of the container<ul style="list-style-type: none">a) Pressureb) Confinementc) Structural integrityd) Rupture	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>2. Pressure is created by physical means, no chemical change</p> <ul style="list-style-type: none">a) Boiler explosionb) Balloonc) Boiling Liquid Expanding Vapor Explosion (BLEVE) <p>B. Chemical explosion</p> <p>1. The sudden and rapid escape of gases accompanied by high temperatures, violent shock, and loud noise</p> <ul style="list-style-type: none">a) Conversion of a solid or liquid explosive compoundb) Gases produced have a much higher volume than the original substancec) Extreme temperatures usually several thousand degreesd) Pressure is created by chemical conversion<ul style="list-style-type: none">1) High explosives<ul style="list-style-type: none">• Dynamite• Detonating cord2) Low explosives<ul style="list-style-type: none">• Black powder• Smokeless powder3) A pipe bomb filled with a low explosive must undergo a chemical explosion first<ul style="list-style-type: none">• Once that has occurred, the gases produced in the chemical explosion will create an over pressurization causing the container (pipe) to rupture• Also true with dry ice and foil acid chemical bombs4) There will be a definite blast seat or point of detonation<ul style="list-style-type: none">• Evidence of crushing, splintering, and shattering (seated)	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> • If after an initial assessment of the explosion scene, the investigator determines that the explosion is due to detonation of explosives and/or an improvised explosive device (IED), the scene investigation must stop • The scene now has to be further searched for additional explosives and/or IEDs by qualified personnel <p>e) Forms of energy release</p> <ol style="list-style-type: none"> 1) Heat 2) Light 3) Sound <p>2. Combustion explosion is the most common chemical explosion</p> <ol style="list-style-type: none"> a) Rapid burning of vapors, gases, and dusts b) Diffuse vapor explosions are a combination of fuel and an oxidizing agent <ol style="list-style-type: none"> 1) Air c) The most common explosions are those caused by the burning of combustible hydrocarbon fuels d) Fuel air ratio must be in proper ratio to support combustion <ol style="list-style-type: none"> 1) A lean fuel-air ratio or lower explosive limit (LEL) within the flammable range will produce a more violent combustion explosion <ul style="list-style-type: none"> • Not much postexplosion fire 2) A rich fuel-air ratio or upper explosive limit (UEL) within the flammable range will produce a longer less violent combustion explosion <ul style="list-style-type: none"> • Fuel is consumed during the explosion 3) The optimum fuel-air ratio is called a stoichiometric mixture or ratio <ul style="list-style-type: none"> • Most violent 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> • Most efficient combustion • Most damage <p>e) The damage can be more severe away from the point of ignition</p> <ol style="list-style-type: none"> 1) This is due to the fuel-air ratio <p>f) A defined blast seat or point of detonation will not exist (nonseated)</p> <p>g) The underground migration of fuel gases</p> <ol style="list-style-type: none"> 1) Soil surrounding underground pipes/utility lines is more porous and less dense 2) Fuel vapors may migrate laterally if the ground is obstructed by rain, snow, freezing, or new paving 3) Odorant verification <ul style="list-style-type: none"> • The odorant in gases such as <i>t</i>-butyl and ethyl mercaptan may be reduced and become undetected under certain conditions <p>h) Types of diffuse vapor explosion</p> <ol style="list-style-type: none"> 1) Backdraft 2) Natural gas 3) LPG 4) Gasoline 5) Anhydrous ammonia 6) Flour 7) Coal dust 8) Metallic dusts 9) Acetylene 10)Sawdust <p>i) Backdraft or smoke explosion</p> <ol style="list-style-type: none"> 1) Happens in the decay or smoldering phase 2) CO and other hot gases act as fuel 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>3) Oxygen introduced, explosion occurs</p> <ul style="list-style-type: none"> • Fuel = carbon monoxide Fuel-air ratio of CO = 12.5% to 74% • Heat = hot gases • Oxygen = missing <p>IV. RECOGNITION FACTORS</p> <p>A. Combustion involving vapor/gas explosions</p> <ol style="list-style-type: none"> 1. Structural damage can possibly indicate type of explosive fuel involved 2. Sometimes the damage might correspond with what type of fuel that is being used 3. The weaker portion of the structure will exhibit the most damage no matter what type of fuel was involved 4. May exhibit more damage at the upper levels or lower levels due to the mixing of vapors or turbulence of vapors <ol style="list-style-type: none"> a) Natural gas (or manufactured gas) <ol style="list-style-type: none"> 1) Lighter than air and will rise to upper levels of the structure 2) Explosions involving natural gas may produce thermal damage at upper levels - explosion damage may be generalized or even at the lower levels of the room b) Liquefied petroleum gases (LPG) such as butane or propane <ol style="list-style-type: none"> 1) Heavier than air and may settle to lower levels of the structure 2) Explosions involving LPG may produce damage centered at the lower levels of the area involved and are more likely to produce sustained fire damage c) Ignitable liquid vapors <ol style="list-style-type: none"> 1) Heavier than air and will normally settle to lower levels of the structure 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2) Explosions involving flammable vapors might produce damage centered at the lower levels of the area involved 5. Explosions may occur during attempted suicides <ul style="list-style-type: none"> a) Many people wrongly believe L.P. and natural gases to be poisonous and they may attempt to use gas fueled cooking equipment to commit suicide b) Check for extinguished pilot lights and controls set to "high" 6. Fuel lines <ul style="list-style-type: none"> a) Destruction of fuel lines during fire may increase burn rate and the resulting charring may appear unnatural or may produce a false indicator suggesting point or origin at or near appliance b) Point of origin in area of gas appliance <ul style="list-style-type: none"> 1) Requires confirmation of appliance malfunction c) Fuel line coupling may loosen as a result of the fire 7. Window glass a considerable distance from the structure <ul style="list-style-type: none"> a) Most common signs of over-pressurization <ul style="list-style-type: none"> 1) Sooted or smoke stained glass may indicate a fire before the explosion 2) Clean glass may indicate an explosion before the fire B. Dust explosions as a fire cause <ul style="list-style-type: none"> 1. Many common materials may explode when in dust form <ul style="list-style-type: none"> a) Fires may or may not result <ul style="list-style-type: none"> 1) Sawdust 	<p>Have the students cite some examples of a dust explosion.</p>



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none"> 2) Flour 3) Charcoal dust 4) Milk powder 5) Rice 6) Grain b) Factors influencing possibility of dust explosions <ul style="list-style-type: none"> 1) Size of dust particles 2) Dust concentration 3) Impurities present 4) Oxygen concentration 5) Strength or source of ignition c) Involved area may appear to have suffered a "flash fire" with no single point of origin C. Intentional criminal explosions <ul style="list-style-type: none"> 1. Improvised explosive device (IED) <ul style="list-style-type: none"> a) Pipe bomb 2. Explosion effects <ul style="list-style-type: none"> a) Blast pressure <ul style="list-style-type: none"> 1) Positive pressure 2) Negative pressure b) Fragmentation or shrapnel effect <ul style="list-style-type: none"> 1) Primary 2) Secondary c) Incendiary or thermal effect <ul style="list-style-type: none"> 1) Detonating explosions produce extremely high temperatures of very limited duration 2) Deflagration explosions produce lower temperatures, but for much longer periods d) Seismic effect <ul style="list-style-type: none"> 1) Earth tremors <ul style="list-style-type: none"> • Damage to underground utilities, pipelines, and tanks 	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<p>D. Unintentional/criminal explosions</p> <ol style="list-style-type: none">1. Incendiary event<ol style="list-style-type: none">a) Explosion occurs while ignitable liquid is being used as an accelerant<ol style="list-style-type: none">1) Gasoline2. Release of flammable gas/vapor during a criminal clandestine event<ol style="list-style-type: none">a) Butane<ol style="list-style-type: none">1) Manufacturing of "Honey Oil" <p>V. TERMINOLOGY</p> <p>NOTE: Refer students to the Glossary in their student supplement for additional definitions.</p> <p>A. High order explosion</p> <ol style="list-style-type: none">1. An explosion that has functioned as designed2. The order of explosions were proper and all of the explosives were consumed in the explosion <p>B. Low order explosion</p> <ol style="list-style-type: none">1. An explosion that has not functioned as designed2. An improper order of explosives or the explosives were too old and were not consumed by the explosion3. Can be a very dangerous situation4. Qualified bomb technician should be contacted for further assistance <p>VI. SAFETY</p> <p>A. Do not touch or move explosives</p> <p>B. Notify bomb squad and local law enforcement</p> <p>C. Secure area</p> <ol style="list-style-type: none">1. Develop perimeter<ol style="list-style-type: none">a) 900 feet, under cover, in all directions, or 1.5 times the distance between the point of detonation and the furthest piece of debris located whichever is greater	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

PRESENTATION	APPLICATION
<ul style="list-style-type: none">b) Secondary devicesc) Scene preservation<ul style="list-style-type: none">1) Designate a command post2) Identify possible witnesses	



FIRE INVESTIGATION 1A

Fire Origin and Cause Determination

Summary:

Safety and securing the area are the first concerns of the fire investigator. The recognition of the type of explosion is a primary function of the fire investigator. If the explosion is suspected to be from the detonation of an explosive and/or IED, the scene examination must be cleared by qualified personnel before the investigator can proceed.

Evaluation:

The student will complete the summative test at a time determined by the instructor.

Assignment:

Review your notes and read NFPA 921: Guide to Fire and Explosive Investigations, NFPA, 2008 Edition, Chapter 9: Building Fuel Gas Systems, Page 921-91, Sections 9.2.4-9.2.4.3 and Chapter 21: Explosions, Pages 921-168 through 921-184, Sections 21.1-21.17.6 in order to prepare yourself for the upcoming test. Study for our next session.



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Appendix A: Formative Test and Answer Key #1

Each answer space is worth five points. Some questions may have more than one correct answer. You have 30 minutes to complete the entire test.

SCORING	Total Possible	80% Minimum	Score	Pass or Fail?
Each answer space is worth five points	100	80		

SECTION I

INSTRUCTIONS: Section I is a multiple-choice test. For each of the following questions or statements, draw a circle around the letter preceding the one best answer.

EXAMPLE: The Incident Command System was developed by the

- a. school system
- b. fire service
- c. state legislature
- d. NRA

1. In the 1970s, arson had reached epidemic proportions throughout the country. Congress commissioned a study, which identified several shortcomings public agencies were experiencing with how arson was handled, as well as the deficiencies fire investigators had in training. This document was known as

- a. A Feasibility Study
- b. Kirk's Fire Investigation
- c. **America Burning**
- d. The Scientific Method

Answer found in Student Supplement, SFT, 2010 Edition, Page 10

2. Which code authorizes local agencies to investigate fires?

- a. **California Fire Code (CFC)**
- b. Health and Safety Code (H&S)
- c. Public Resources Code (PRC)
- d. National Fire Protection (NFPA)

Answer found in Student Supplement, SFT, 2010 Edition, Page 7



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

3. "The distinct pattern of working that comes to be associated with a particular criminal" refers to
- a. subrogation
 - b. corpus delicti
 - c. fire propagation

➤ d. ***modus operandi***

Answer found in Student Supplement, SFT, 2010 Edition, Page 17

4. NFPA defines a fire investigation as "The process of determining the origin, cause, and _____ of a fire or explosion."

- a. accountability
- b. effect
- c. purpose

➤ d. ***development***

Answer found in NFPA 921, 2008 Edition, Page 921-12, Section 3.3.59

5. Another term for the development of a hypothesis is

- a. recognition of the problem
- b. collecting the data
- c. ***inductive reasoning***
- d. analyzing the data

Answer found in NFPA 921, 2008 Edition, Page 921-16, Section 4.3.5

6. The scientific method is comprised of seven steps. Which step is occurring when the fire investigator is observing, experimenting, or using other direct data gathering means?

- a. Recognizing the need
- b. Defining the problem
- c. Testing the hypothesis

➤ d. ***Collecting data***

Answer found in NFPA 921, 2008 Edition, Page 921-16, Figure 4.3



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

7. Which one of the following four steps of the scientific method **cannot** be used repetitively during an investigation?

- a. Collecting data
- b. Analyzing data
- c. Developing a hypothesis
- d. **Defining the problem**

Answer found in NFPA 921, 2008 Edition, Page 921-16, Figure 4.3

8. Which one of the following is **not** a form of heat transfer?

- a. **Thermal**
- b. Conductive
- c. Convective
- d. Radiant

Answer found in NFPA 921, 2008 Edition, Page 921-20, Section 5.5.1.3

9. Flashpoint refers to the flammable vapors above what type of fuel?

- a. Solid
- b. **Liquid**
- c. Gas
- d. Particulate

Answer found in NFPA 921, 2008 Edition, Page 921-28, Section 5.7.3.1

10. Which Supreme Court case was in reference to a warrantless search of a residence in which arson evidence was illegally seized?

- a. Weeks v. United States 232 U.S. 383
- b. **Michigan v. Clifford 464 U.S. 287**
- c. Minnesota v. Dickerson 508 U.S. 366
- d. Michigan v. Jackson 475 U.S. 625

Answer found in Student Supplement, SFT, 2010 Edition, Page 19



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

11. The type of warrant needed in California to "generally allow those charged with the responsibility, by ordinance or statute, to investigate the origin and cause of a fire and to fulfill their obligation according to the law" is called

- a. a criminal warrant
- b. a basket warrant
- c. a traditional warrant
- d. **an inspection warrant**

Answer found in Student Supplement, SFT, 2010 Edition, Page 24

12. What U.S. Constitutional Amendment allows citizens the right to be secure in their person, houses, paper, and effects, against unreasonable searches and seizures?

- a. 3rd
- b. **4th**
- c. 5th
- d. 6th

Answer found in NFPA 921, 2008 Edition, Page 921-102, Figure 11.2

SECTION II

INSTRUCTIONS: Section II is a true-false test. If the statement is true, draw a circle around the "T." If the statement is false, draw a circle around the "F."

EXAMPLE: (T) F The Incident Command System was developed by the fire service.

➤T F 13. Home fires caused 2,755 or 83% of the civilian fire deaths.

Answer found in Student Supplement, SFT, 2010 Edition, Page 4

➤T F 14. The NFPA 921 document is intended to establish guidelines and recommendations.

Answer found in NFPA 921, 2008 Edition, Page 921-7, Section 1.2.1

T ➤F 15. NFPA 921 states that the scientific method can be applied only when the fire investigator deems he or she needs to use it.

Answer found in NFPA 921, 2008 Edition, Page 921-7, Section 1.3.2



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

- T F 16.The systematic approach that provides for the organizational and analytical process desirable and necessary in a fire investigation is known as the scientific method.

Answer found in NFPA 921, 2008 Edition, Page 921-16, Section 4.2

- T ➤F 17.The fire triangle was a three-sided geometrical form that consisted fuel, heat, and air. Now, the fire triangle has been replaced with a four-sided geometrical form called the fire tetrahedron. The fourth side that was added was an oxidizing agent.

Answer found in NFPA 921, 2008 Edition, Page 921-18, Figure 5.1.2

- T F 18.Pyrolysis is defined as the "Thermal decomposition involves irreversible changes in the chemical structure of a material due to the effects of heat."

Answer found in NFPA 921, 2008 Edition, Page 921-19, Section 5.2.2.2

- T F 19.Flashover lasting 3-5 minutes is common in a residential room fire test.

Answer found in NFPA 921, 2008 Edition, Page 921-39, Section 5.10.4.6

- T F 20.The following are the four general methods by which an investigator has a "right of entry" to gain access to the premise or fire scene: consent, exigent circumstance, administrative warrant, or a criminal warrant.

Answer found in NFPA 921, 2008 Edition, Page 921-103, Section 11.3.3



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Appendix A: Formative Test and Answer Key #2

Each answer space is worth five points. Some questions may have more than one correct answer. You have 30 minutes to complete the entire test.

SCORING	Total Possible	80% Minimum	Score	Pass or Fail?
Each answer space is worth five points	100	80		

SECTION I

INSTRUCTIONS: Section I is a multiple-choice test. For each of the following questions or statements, draw a circle around the letter preceding the one best answer.

EXAMPLE: The Incident Command System was developed by the

- a. school system
- b. fire service
- c. state legislature
- d. NRA

1. Calcined sheet rock indicates

- a. cheap gypsum wallboard
- b. accelerant
- c. **heat exposure with the surface of the gypsum wallboard**
- d. lack of fuel for the fires growth

Answer found in NFPA 921, 2008 Edition, Page 921-45, Section 6.2.1.2

2. What are the three basic causes of fire patterns?

- a. Ventilation, heat, and time
- b. Weather, construction, and heat transfer
- c. **Heat, deposition, consumption or the fire effects**
- d. Overhaul, salvage, and time

Answer found in NFPA 921, 2008 Edition, Page 921-40, Section 6.2.1



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

3. What causes an inverted cone pattern?

- a. Early plume development
- b. No vertical restrictions
- c. Low heat release rate fires

➤ d. **All of the above**

Answer found in NFPA 921, 2008 Edition, Page 921-53, Section 6.3.7.2.1

4. What is a truncated plume pattern?

- a. Proof of fire origin
- b. Suppression caused movement of the plume

➤ c. **Plume intersection with the wall and ceiling**

- d. Fuel package location

Answer found in NFPA 921, 2008 Edition, Page 921-54, Section 6.3.7.5

5. What type of pattern is produced by the growth and movement of fire and the products of combustion away from an initial heat source?

- a. Intensity

➤ b. **Movement**

- c. Ventilation
- d. Fire

Answer found in NFPA 921, 2008 Edition, Page 921-59, Section 6.4.1.1

6. During the voir dire process, the witness has to demonstrate to the court that he or she has the necessary training, education, knowledge, and experience in order to give

- a. a written report

➤ b. **an expert opinion**

- c. testimony
- d. a disposition

Answer found in Student Supplement, SFT, 2010 Edition, Page 31



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

7. Arson to a structure falls under which section of the California Penal Code?

- a. 450b
- b. 451a
- c. **451c**
- d. 455a

Answer found in Student Supplement, SFT, 2010 Edition, Page 52

8. Which word best defines a freehand diagram drawn with minimal tools and completed at the scene.

- a. Diagram
- b. **Sketch**
- c. Notes
- d. Report

Answer found in NFPA 921, 2008 Edition, Page 921-128, Section 15.4.1.1

SECTION II

INSTRUCTIONS: Section II is a true-false test. If the statement is true, draw a circle around the "T." If the statement is false, draw a circle around the "F."

EXAMPLE: (T) F The Incident Command System was developed by the fire service.

- T F 9. Saddle burns are distinctive U- or saddle-shaped patterns that are sometimes found on the top edges of floor joists and are caused by fire burning downward through the floor above the affected joist.

Answer found in NFPA 921, 2008 Edition, Page 921-58, Section 6.3.7.12

- T F 10. The rate of fire growth is determined by the heat release rate (HRR) from burning of individual fuel arrays.

Answer found in NFPA 921, 2008 Edition, Page 921-23, Section 5.6.3.1

- T F 11. Floor fire patterns caused by melting synthetics, heat from flashover, and ignitable liquids may be similar in appearance, shape, size, and lines of demarcation between the burned and unburned areas.

Answer found in NFPA 921, 2008 Edition, Page 921-56, Section 6.3.7.8.6



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

- T ➤F 12.A fuel with a low thermal inertia is more difficult to ignite than a fuel with a high thermal inertia.
Answer found in NFPA 921, 2008 Edition, Page 921-21, Section 5.5.2.3
- T F 13.Low-density materials like polyurethane foam have a low thermal inertia and the surface temperature will increase quickly.
Answer found in NFPA 921, 2008 Edition, Page 921-21, Figure 5.5.2.3
- T ➤F 14.Char appearance and depth can indicate whether the fire was accelerated or not.
Answer found in NFPA 921, 2008 Edition, Page 921-40, Section 6.2.4.3
- T F 15.Fire patterns are the visible or measurable physical fire effects that remain after a fire.
Answer found in NFPA 921, 2008 Edition, Page 921-40, Section 6.2.1
- T F 16.The voir dire process is a series of questions presented to a witness by both the prosecution.
Answer found in Student Supplement, SFT, 2010 Edition, Page 31
- T ➤F 17.There is no difference in the rules of testifying in a California state court and in a federal court located in California.
Answer found in Student Supplement, SFT, 2010 Edition, Page 31
- T F 18.A bridge and a tunnel are classified as a structure under the definitions of the California Penal Code.
Answer found in Student Supplement, SFT, 2010 Edition, Page 51
- T ➤F 19.The statute of limitations for California Penal Code Section 451a, arson that causes great bodily harm, is 3 years.
Answer found in Student Supplement, SFT, 2010 Edition, Page 58
- T ➤F 20.Under California law, Penal Code Section 26 states that all persons under the age of 13 years are not responsible for their criminal actions.
Answer found in Student Supplement, SFT, 2010 Edition, Page 51



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Appendix A: Formative Test and Answer Key #3

Each answer space is worth five points. Some questions may have more than one correct answer. You have 30 minutes to complete the entire test.

SCORING	Total Possible	80% Minimum	Score	Pass or Fail?
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SECTION I

INSTRUCTIONS: Section I is a multiple-choice test. For each of the following questions or statements, draw a circle around the letter preceding the one best answer.

EXAMPLE: The Incident Command System was developed by the

- a. school system
- b. fire service
- c. state legislature
- d. NRA

1. The ignition process involves which three components?

- a. Heating, transmission, and thermal inertia
- b. **Generation, transmission, and heating**
- c. Thermal inertia, heating, and ignition temperature
- d. Ignition temperature, thermal inertia, and transmission

Answer found in NFPA 921, 2008 Edition, Page 921-156, Section 18.3.3.

2. Even though there may be no physical evidence indicating the cause of a fire after the point of origin is clearly defined, a cause may be inferred through the

- a. burn indicators
- b. latent heat of energy
- c. materials first ignited
- d. **process of elimination**

Answer found in NFPA 921, 2008 Edition, Page 921-156, Section 18.2.1



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

3. Which of the following is **not** a classification of a fire cause?

- a. Incendiary
- b. **Suspicious**
- c. Natural
- d. Accidental

Answer found in NFPA 921, 2008 Edition, Page 921-158, Section 19.2.1

4. When electrical heating equipment (portable or stationary) is suspected as the cause, it is likely due to combustibles contacting the

- a. thermostat
- b. **heating elements**
- c. element screen
- d. external housing

Answer found in NFPA 921, 2008 Edition, Page 921-204, Section 24.5.7

5. To prevent overheating of water in a coffee maker, the unit is protected by a

- a. NCO
- b. CPO
- c. **TCO**
- d. FBI

Answer found in NFPA 921, 2008 Edition, Page 921-206, Section 24.6.2

6. Residential portable space heaters are generally divided into which of the following two groups?

- a. Heat exchanger and condenser
- b. Thermostatic and radiant
- c. Thermostatic and convective
- d. **Convective and radiant**

Answer found in NFPA 921, 2008 Edition, Page 921-207, Section 24.6.8



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

7. An asphalt-based potting compound that provides better heat transfer, reduces noise, and holds internal parts in place is an integral part of

- a. **fluorescent light ballast**
- b. solenoids and relays
- c. metal halide lamps
- d. high intensity lighting

Answer found in NFPA 921, 2008 Edition, Page 921-205, Section 24.5.8.1.5

8. Which one of the following is not required to be brought together in order for the fire investigator to determine the cause of a fire?

- a. Fuel
- b. **Endothermic reaction**
- c. Oxidizer
- d. Ignition source

Answer found in NFPA 921, 2008 Edition, Page 921-155, Section 18.1.1

9. Bonding the service equipment breaker or fuse panel to a metallic cold water pipe that extends at least 10 feet into the earth or an 8-foot long galvanized or copper rod driven into the earth to a permanent moisture level is known as

- a. overcurrent protection
- b. ground fault
- c. **grounding**
- d. floating neutral

Answer found in NFPA 921, 2008 Edition, Page 921-72, Section 8.5.1

10. Electrical equipment that is used to provide against short circuits, ground faults, and damaging load currents is known as

- a. **overcurrent protection**
- b. ground fault
- c. grounding
- d. floating neutral

Answer found in NFPA 921, 2008 Edition, Page 921-73, Section 8.6



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

11. Under certain conditions, particularly with liquid hydrocarbons, a static electric charge may form in the liquid becoming a possible ignition hazard with all the following operations **except**

- a. pumping and spraying
- b. filtering and agitating
- c. mixing and pouring
- d. **humidification and bonding**

Answer found in NFPA 921, 2008 Edition, Page 921-87, Section 12.2.2

SECTION II

INSTRUCTIONS: Section II is a true-false test. If the statement is true, draw a circle around the "T." If the statement is false, draw a circle around the "F."

EXAMPLE: (T) F The Incident Command System was developed by the fire service.

➤T F 12. The physical configuration of the fuel plays a significant role in its ability to be ignited.

Answer found in NFPA 921, 2008 Edition, Page 921-27, Section 5.7.1

➤T F 13. Piloted ignition occurs when an external ignition source, such as a small flame, acts to ignite combustibles and flammable items.

Answer found in NFPA 921, 2008 Edition, Page 921-26, Section 5.7

➤T F 14. Flammable gases can only be ignited by a spark or piloted ignition source within a specific ranges of a fuel air mixture.

Answer found in NFPA 921, 2008 Edition, Page 921-27, Section 5.7.2.1

T ➤F 15. The flashpoint of a liquid has no connection to its fuel air ratio or concentration.

Answer found in NFPA 921, 2008 Edition, Page 921-28, Section 5.7.3.1

➤T F 16. The requirement for ignition is that the temperature of the electrical source be maintained long enough to bring the adjacent fuel to its ignition temperature.

Answer found in NFPA 921, 2008 Edition, Page 921-79, Section 8.9.1.1



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

- T ➤F 17.The use of copper or aluminum conductors of sufficient size, in wiring systems, will cause increased resistance and possible overheating of the conductor.
Answer found in NFPA 921, 2008 Edition, Page 921-79, Section 8.9.2.1.1
- T ➤F 18.The beading on the end of a copper or aluminum conductor is a positive indication that it is the fire cause.
Answer found in NFPA 921, 2008 Edition, Page 921-86, Section 8.11.10
- T F 19.If the overcurrent protection is defeated or defective, then a short circuit may become an overload and an ignition source.
Answer found in NFPA 921, 2008 Edition, Page 921-86, Section 8.11.9
- T F 20.Aluminum wiring has a lower conductivity rate than copper wiring.
Answer found in NFPA 921, 2008 Edition, Page 921-78, Section 8.7.4.1



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Appendix B: Formative Test #1

Each answer space is worth five points. Some questions may have more than one correct answer. You have 30 minutes to complete the entire test.

SCORING	Total Possible	80% Minimum	Score	Pass or Fail?
Each answer space is worth five points	100	80		

SECTION I

INSTRUCTIONS: Section I is a multiple-choice test. For each of the following questions or statements, draw a circle around the letter preceding the one best answer.

EXAMPLE: The Incident Command System was developed by the

- a. school system
- b. fire service
- c. state legislature
- d. NRA

1. In the 1970s, arson had reached epidemic proportions throughout the country. Congress commissioned a study, which identified several shortcomings public agencies were experiencing with how arson was handled, as well as the deficiencies fire investigators had in training. This document was known as

- a. A Feasibility Study
- b. Kirk's Fire Investigation
- c. America Burning
- d. The Scientific Method

Answer found in Student Supplement, SFT, 2010 Edition, Page 10

2. Which code authorizes local agencies to investigate fires?

- a. California Fire Code (CFC)
- b. Health and Safety Code (H&S)
- c. Public Resources Code (PRC)
- d. National Fire Protection (NFPA)



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

3. "The distinct pattern of working that comes to be associated with a particular criminal" refers to

- a. subrogation
- b. corpus delicti
- c. fire propagation
- d. modus operandi

4. NFPA defines a fire investigation as "The process of determining the origin, cause, and _____ of a fire or explosion."

- a. accountability
- b. effect
- c. purpose
- d. development

5. Another term for the development of a hypothesis is

- a. recognition of the problem
- b. collecting the data
- c. inductive reasoning
- d. analyzing the data

6. The scientific method is comprised of seven steps. Which step is occurring when the fire investigator is observing, experimenting, or using other direct data gathering means?

- a. Recognizing the need
- b. Defining the problem
- c. Testing the hypothesis
- d. Collecting data



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

7. Which one of the following four steps of the scientific method **cannot** be used repetitively during an investigation?

- a. Collecting data
- b. Analyzing data
- c. Developing a hypothesis
- d. Defining the problem

8. Which one of the following is **not** a form of heat transfer?

- a. Thermal
- b. Conductive
- c. Convective
- d. Radiant

9. Flashpoint refers to the flammable vapors above what type of fuel?

- a. Solid
- b. Liquid
- c. Gas
- d. Particulate

10. Which Supreme Court case was in reference to a warrantless search of a residence in which arson evidence was illegally seized?

- a. Weeks v. United States 232 U.S. 383
- b. Michigan v. Clifford 464 U.S. 287
- c. Minnesota v. Dickerson 508 U.S. 366
- d. Michigan v. Jackson 475 U.S. 625



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

11. The type of warrant needed in California to "generally allow those charged with the responsibility, by ordinance or statute, to investigate the origin and cause of a fire and to fulfill their obligation according to the law" is called
- a. a criminal warrant
 - b. a basket warrant
 - c. a traditional warrant
 - d. an inspection warrant
12. What U.S. Constitutional Amendment allows citizens the right to be secure in their person, houses, paper, and effects, against unreasonable searches and seizures?
- a. 3rd
 - b. 4th
 - c. 5th
 - d. 6th

SECTION II

INSTRUCTIONS: Section II is a true-false test. If the statement is true, draw a circle around the "T." If the statement is false, draw a circle around the "F."

EXAMPLE: (T) F The Incident Command System was developed by the fire service.

- T F 13. Home fires caused 2,755 or 83% of the civilian fire deaths.
- T F 14. The NFPA 921 document is intended to establish guidelines and recommendations.
- T F 15. NFPA 921 states that the scientific method can be applied only when the fire investigator deems he or she needs to use it.



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

- T F 16. The systematic approach that provides for the organizational and analytical process desirable and necessary in a fire investigation is known as the scientific method.
- T F 17. The fire triangle was a three-sided geometrical form that consisted fuel, heat, and air. Now, the fire triangle has been replaced with a four-sided geometrical form called the fire tetrahedron. The fourth side that was added was an oxidizing agent.
- T F 18. Pyrolysis is defined as the "Thermal decomposition involves irreversible changes in the chemical structure of a material due to the effects of heat."
- T F 19. Flashover lasting 3-5 minutes is **not** unusual in a residential room fire test.
- T F 20. The following are the four general methods by which an investigator has a "right of entry" to gain access to the premise or fire scene: consent, exigent circumstance, administrative warrant, or a criminal warrant.



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Appendix B: Formative Test #2

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- a. cheap gypsum wallboard
- b. accelerant
- c. heat exposure with the surface of the gypsum wallboard
- d. lack of fuel for the fires growth

2. What are the three basic causes of fire patterns?

- a. Ventilation, heat, and time
- b. Weather, construction, and heat transfer
- c. Heat, deposition, consumption or the fire effects
- d. Overhaul, salvage, and time



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

3. What causes an inverted cone pattern?

- a. Early plume development
- b. No vertical restrictions
- c. Low heat release rate fires
- d. All of the above

4. What is a truncated plume pattern?

- a. Proof of fire origin
- b. Suppression caused movement of the plume
- c. Plume intersection with the wall and ceiling
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5. What type of pattern is produced by the growth and movement of fire and the products of combustion away from an initial heat source?

- a. Intensity
- b. Movement
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6. During the voir dire process, the witness has to demonstrate to the court that he or she has the necessary training, education, knowledge, and experience in order to give

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FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

7. Arson to a structure falls under which section of the California Penal Code?

- a. 450b
- b. 451a
- c. 451c
- d. 455a

8. Which word best defines a freehand diagram drawn with minimal tools and completed at the scene.

- a. Diagram
- b. Sketch
- c. Notes
- d. Report

SECTION II

INSTRUCTIONS: Section II is a true-false test. If the statement is true, draw a circle around the "T." If the statement is false, draw a circle around the "F."

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T F 9. Saddle burns are distinctive U- or saddle-shaped patterns that are sometimes found on the top edges of floor joists and are caused by fire burning downward through the floor above the affected joist.

T F 10. The rate of fire growth is determined by the heat release rate (HRR) from burning of individual fuel arrays.

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FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

- T F 12.A fuel with a low thermal inertia is more difficult to ignite than a fuel with a high thermal inertia.
- T F 13.Low-density materials like polyurethane foam have a low thermal inertia and the surface temperature will increase quickly.
- T F 14.Char appearance and depth can indicate whether the fire was accelerated or not.
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- T F 16.The voir dire process is a series of questions presented to a witness by both the prosecution.
- T F 17.There is no difference in the rules of testifying in a California state court and in a federal court located in California.
- T F 18.A bridge and a tunnel are classified as a structure under the definitions of the California Penal Code.
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- T F 20.Under California law, Penal Code Section 26 states that all persons under the age of 13 years are not responsible for their criminal actions.



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

Appendix B: Formative Test #3

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- a. Heating, transmission, and thermal inertia
- b. Generation, transmission, and heating
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2. Even though there may be no physical evidence indicating the cause of a fire after the point of origin is clearly defined, a cause may be inferred through the

- a. burn indicators
- b. latent heat of energy
- c. materials first ignited
- d. process of elimination



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

3. Which of the following is **not** a classification of a fire cause?

- a. Incendiary
- b. Suspicious
- c. Natural
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FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

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- fluorescent light ballast
 - solenoids and relays
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- Fuel
 - Endothermic reaction
 - Oxidizer
 - Ignition source
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- overcurrent protection
 - ground fault
 - grounding
 - floating neutral
10. Electrical equipment that is used to provide against short circuits, ground faults, and damaging load currents is known as
- overcurrent protection
 - ground fault
 - grounding
 - floating neutral



FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

11. Under certain conditions, particularly with liquid hydrocarbons, a static electric charge may form in the liquid becoming a possible ignition hazard with all the following operations **except**
- a. pumping and spraying
 - b. filtering and agitating
 - c. mixing and pouring
 - d. humidification and bonding

SECTION II

INSTRUCTIONS: Section II is a true-false test. If the statement is true, draw a circle around the "T." If the statement is false, draw a circle around the "F."

EXAMPLE: T F The Incident Command System was developed by the fire service.

- | | | |
|---|---|---|
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| T | F | 13. Piloted ignition occurs when an external ignition source, such as a small flame, acts to ignite combustibles and flammable items. |
| T | F | 14. Flammable gases can only be ignited by a spark or piloted ignition source within a specific ranges of a fuel air mixture. |
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FIRE INVESTIGATION 1A

Fire Origin And Cause Determination

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