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Basic Fire
Methodology

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Knowledge Objectives

- Explain the purpose of the scientific method.
- Explain how each step of the scientific method is used in a fire investigation.

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Skills Objectives

- Conduct an investigation following the steps of the scientific method.

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Introduction

- An investigation should be carried out with a systematic approach.
 - Ensures that all aspects of fire scene are addressed
- The scientific method is a systematic approach.

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Scientific Method

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    graph TD
      A[Recognize the need  
(identify the problem)] --> B[Define the problem]
      B --> C[Collect data]
      C --> D[Analyze the data]
      D --> E[Develop a hypothesis  
(inductive reasoning)]
      E --> F[Test the hypothesis  
(deductive reasoning)]
      F --> G[Select final hypothesis]
      F --> C
      F --> D
      F --> E
    
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Fire Investigation and the Scientific Method

- Often fire investigators follow the scientific method.
 - Without defining it by name
- For example, documenting the scene from outside to inside
 - This is one part of the scientific method—collecting data.

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Steps of the Scientific Method Applied to Fire Investigations

1. Recognize the need to use the scientific method.
2. Define the problem.
3. Collect data.
4. Analyze the data.
5. Develop a hypothesis.
6. Test the hypothesis.

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Step 1: Recognize the Need to Use the Scientific Method

- Realize that there is a problem to be resolved.
- Example:
 - Investigator is notified of incident
 - Investigator is asked to determine its origin and cause

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Step 2: Define the Problem

- Takes place upon arriving on scene, or when assignment is given
- Determining origin and cause of fire
 - Example: fire originated in second-floor bedroom

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Step 3: Collect Data (1 of 3)

- Data include:
 - Recognition of physical evidence (fire patterns, fuel loads, etc.)
 - Collection of materials for laboratory examination
 - Results of laboratory examinations
 - Documentation of personal observations (eg, witness statements)

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Step 3: Collect Data (2 of 3)

- Data include (cont'd):
 - Documentation of fire scene (photographs, sketches, notes)
 - Official reports (eg, from fire and police departments)
 - Documentation or results from prior investigations

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Step 3: Collect Data (3 of 3)

- Empirical data are collected using scientific method
 - Can be verified or validated as true
- Important to collect and document data
 - Opportunity may be lost when scene is demolished or repaired

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Step 4: Analyze the Data

- Examine data objectively.
- Purpose:
 - To evaluate its meaning
 - To determine a possible hypothesis

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Step 5: Develop a Hypothesis

- Develop hypothesis:
 - Based on empirical data
 - To explain events of incident
- Referred to as inductive reasoning
- There may be more than one hypothesis.

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Step 6: Test the Hypothesis (1 of 4)

- Testing may give the final hypothesis, or conclusions.
- Deductive reasoning is often used.
 - Investigator uses knowledge and skills to challenge or test hypothesis analytically
 - Known as cognitive testing
- Expectation bias should be avoided.

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Step 6: Test the Hypothesis (2 of 4)

- Laboratory testing or fire modeling may be helpful.
- The hypothesis is supported, unsupported, or refuted.
 - If not supported, investigator may have to return to earlier step of scientific method

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Step 6: Test the Hypothesis (3 of 4)

Enlist the assistance of a knowledgeable peer to review your process and conclusions



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Step 6: Test the Hypothesis (4 of 4)

Level	Explanation
Probable	More likely true than not (more than 50% likely of being true)
Possible	Feasible (often used when two hypotheses have the same level of certainty)
Suspected	Not enough certainty to be considered an expert opinion

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The Basic Methods of Fire Investigation (1 of 2)

- Scientific method for fire investigations:
 - Receive the assignment.
 - Prepare for the investigation.
 - Conduct the investigation.
 - Collect and preserve evidence.

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The Basic Methods of Fire Investigation (2 of 2)

- Scientific method for fire investigations (cont'd):
 - Analyze the incident.
 - Draw conclusions.
 - Follow reporting procedures.

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Reviewing the Procedure (1 of 2)

- Administrative review
 - Checks that procedure manual was followed
- Technical review
 - Critique of investigator's work and findings
 - Useful if it is serious
 - May be biased through working relationships

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Reviewing the Procedure (2 of 2)

- Peer review
 - Useful, but reviewers likely don't have resources to question investigator's data
- Litigation may involve others who challenge investigator's methods and findings.

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Summary (1 of 4)

- The scientific method is a systematic method of problem solving.
- Steps of the scientific method are:
 - Recognizing and identifying the problem
 - Defining the problem
 - Collecting information

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Summary (2 of 4)

- Steps of the scientific method (cont'd):
 - Analyzing the information
 - Developing hypotheses
 - Testing the hypotheses to determine whether the results are reliable and valid in order to reach a final hypothesis

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Summary (3 of 4)

- Proper documentation will validate analysis of the data that are collected.
- After all evidence and data are collected, the whole body of evidence and data is reviewed using inductive reasoning; evidence is looked at objectively in order to evaluate its meaning and determine a possible hypothesis.

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Summary (4 of 4)

- The hypothesis is challenged or tested through deductive reasoning.
- If a hypothesis cannot withstand a challenge or test, the investigator may need to return to earlier steps of the scientific method.