

Fire Investigation Independent Study Continuing Education

NFPA 921 UNIT #18 – Study Guide

NFPA 921 Guide for Fire and Explosion Investigations 2004 Edition

Objective: Given an examination the participant shall demonstrate a knowledge and understanding of explosions.

Reading/study assignment: NFPA 921 Guide for Fire and Explosion Investigations, 2004 Edition, pp. 921-149 through 921-165 (Chapter 21)

Study/reference questions:

What is reflection and how may this modify the blast pressure front?

What are some possible ignition sources and is this easy to determine?

What is shrapnel?

If air movement is the dominant mechanism for moving gases in a structure, what affects the movement of a gas or vapor from a container or a pipeline?

What is the difference between a deflagration and detonation?

What is a nuclear explosion? Who will deal with these?

What is the primary criteria for an explosion?

Is bursting of a tank from hydrostatic pressure an explosion? Why or why not?

What type explosions do fire investigators deal with?

What is a BLEVE?

How does localized heating of a container relate to the occurrence of a BLEVE?

What is a chemical explosion?

Combustion reactions are also called what other type reactions? Why?

Are combustion reactions deflagrations or detonations?

What are some of the most common fuels involved in combustion explosions?

What is an explosion?

Is the analysis of an ignition source always an easy part of the investigation? Why or why not?

What is an electrical explosion? What is an electrical explosion effect example?

What are high order and low order explosives?

What is involved in the analysis to establish a cause and what methods may be used to assist in this determination process?

What are tidemarks and how and why do they occur?

What are high yield and low yield explosives?

The difference between high order and low order explosions is a function of what?

What is low order damage and how will debris produced appear?

Does a BLEVE need a flammable/combustible liquid?

What are the four major groups of the effects of explosions?

Under ideal theoretical circumstances, how will an explosion manifest itself?

What is a mechanical explosion?

What is a blast pressure front effect?

What is high order damage and how will debris produced appear?

What are the two phases of a blast pressure front?

What are dust explosions and what are some examples of dusts that may be involved?

What is a backdraft explosion?

What is the “impulse” of an explosion?

What is a positive pressure phase?

Can an explosion that is secondary or cascades into an adjacent compartment be more violent than the primary explosion? Why or why not?

What are explosives?

What manifestation indicates an explosion?

Which phase will cause secondary damage and where may it move evidence?

What fuel/air mixtures tend to produce post explosion fire? Why?

What is the ideal theoretical shape of a blast front?

How does rate of pressure rise relate to explosion damage?

What is a blast pressure front?

What phase of an explosion is more powerful?

What is the pressure a well-built residence will seldom exceed without sustaining rupture from an explosion?

What is the size of the seat of an explosion?

Shrapnel may also be referred to as what?

What factors affect the distance missiles may be thrown in an explosion?

How and why can multiple explosions of fuel/air gases occur?

What problems do thermal effect secondary fires create for the fire investigator?

How does thermal effect of a detonation compare with thermal effect of a deflagration?

What are firebrands?

Will venting effect impact maximum pressure development?

What affect may fireballs and firebrands have on an incident?

What is seismic effect?

What is a negative pressure phase?

What type of damage may occur as a result of seismic effect?

What are the factors controlling explosion effects and how may they affect the scene?

What are blast pressure front modifiers?

What is refraction and blast focusing and how may this affect the blast pressure front?

How great an effect will blast pressure front modifiers have in a deflagration?

What are some of the factors that control the effects of an explosion?

In general, what type explosion causes a seated explosion?

What fuels or specific types of explosions may cause a seated explosion?

What is a non-seated explosion?

What are low explosives, some examples, and how are they designed to work?

What fuels may result in non-seated explosions and why do these occur in this way?

What are the most commonly encountered explosions?

What should the investigator do in reference to establishing the origin of an explosion?

What are the common minimum ignition temperatures and energy associated with gas/vapor explosions?

What is another word for seat of an explosion?

What fuel/air mixtures tend to produce less damage? What fuel/air mixtures tend to produce greater damage? Why?

What fuel/air mixtures tend not to produce post explosion fire. Why?

What fuel/air mixtures produce the most violent explosions? Why?

Review table 13-8.

What are fireballs?

What effect may vapor density have on explosion damage?

Fuels with a vapor density of greater than 1.0 will tend to migrate where and what are some of these fuels?

Does the entire volume of a space need to be occupied by a fuel/air mixture for an explosion to occur? Why or why not?

Fuels with a vapor density of less than 1.0 will tend to migrate where and what are some these fuels?

What may have an effect on the mixing of fuel/air gases?

The level of explosion damage within a conventional room is a function of what?

What explosion effects may turbulence within the fuel/air mixture have and what may cause this turbulence?

What effect may the nature of the confining space have on an explosion and what are some examples?

What effect does the location and magnitude of the ignition source have on an explosion? Why?

What are the effects of venting o gas, vapor or dust explosions and what are some examples?

Underground fuel gases may migrate where from a leak?

How does particle size, concentration, turbulence, moisture, and minimum ignition energy affect dust explosions?

What changes and modifies the ideal theoretical shape of a blast front and in what way?

What may stop the upward migration of fuel gases from an underground leak?

Where will the most damage from a blast pressure front occur and what affects it?

Do multiple explosions occur in dust explosions? Why or why not? How may this occur?

What is thermal damage dependent on?

What are some of the factors relevant to the interpretation of explosion damage?

What should be done if additional evidence is found after establishing a perimeter at an explosion scene?

What are backdraft/smoke explosions? How do they occur and what fuels are involved?

What is an outdoor vapor cloud explosion and what is another name(s) for them?

What are high explosives, some examples, and how are they designed to work?

What is required for investigation of explosive incidents and who usually conducts these investigations?

What specific types or configurations may produce seated explosions?

What type approach should be used when investigating an explosion scene and how do explosion scenes differ from fire scenes?

What is the first duty of an investigator at the scene of an explosion and what should they do? Why?

How should the perimeter of an explosion scene be established?

How should the investigator analyze the fuel source and what methods may be used?

What should be done in reference to background information and search patterns at an explosion scene?

What are some of the safety concerns at an explosion scene?

What should the fire investigator do if during the initial scene assessment it is determined that the explosion was fueled by explosives or an improvised explosive device?

What should the investigator do in reference to determining if the incident was an explosion, fire, or both?

What are the different categories the investigator should use when comparing the nature of damage in attempting to identify the potential general fuel type?

How should the fire investigator attempt to determine which types of fuel were available at the explosion scene?

What is the “seat” of an explosion?

What is the name for the material thrown from the crater of an explosion?

What methods would the investigator use in recording findings of a detailed scene assessment?

What must the investigator consider when evaluating a possible ignition source?

Although the fire investigator will not usually be involved in the direct investigation of an explosive or improvised explosive device incident, you should be familiar with elements of the investigation. Study the following topic areas of NFPA 921.

High- or Low-Order Damage

Seated or Non-seated Explosion

Identify Damage Effects of Explosion

Identify Preblast and Postblast Fire Damage

Locate and Identify Articles of Evidence

Identify Force Vectors

Analyze Origin (Epicenter)