

## COMBUSTIBLE DUST AWARENESS

This easy-to-use Leader's Guide is provided to assist in conducting a successful presentation. Featured are:

**INTRODUCTION:** A brief description of the program and the subject that it addresses.

**PROGRAM OUTLINE:** Summarizes the program content. If the program outline is discussed before the video is presented, the entire program will be more meaningful and successful.

**PREPARING FOR AND CONDUCTING THE PRESENTATION:** These sections will help you set up the training environment, help you relate the program to site-specific incidents, and provide program objectives for focusing your presentation.

**REVIEW QUESTIONS AND ANSWERS:** Questions may be copied and given to participants to document how well they understood the information that was presented. Answers to the review questions are provided separately.

### INTRODUCTION

If a combustible dust explosion occurs, it often results in severe injuries, burns or deaths. Employees can reduce the potential for dust explosions by being aware of the risks and following safe work practices to mitigate those risks as well as by following the company's emergency contingency plan. That's the purpose of this program--to review the precautions and procedures workers can follow to prevent dust incidents. Topics include the dust explosion pentagon, chain reaction catastrophes, minimizing available dust, engineering controls and awareness of ignition sources.

### PROGRAM OUTLINE

#### DEFINITION OF A COMBUSTIBLE DUST

- Many types of dust can explode and these include not just organic materials like flour, sugar or wood, but also inorganic materials such as some metals, paint, plastics, pharmaceuticals and even some types of textiles. OSHA has identified more than 130 products or materials that pose a hazard for dust explosion.
- The fact is many facilities that have processes that produce dust or fine particles may be at risk of a dust explosion, often with catastrophic results, unless precautions are taken and proper procedures are followed.
- The National Fire Prevention Association defines combustible dust as "a finely divided combustible particulate solid that presents a flash fire hazard or explosion hazard when suspended in air or the process specific oxidizing medium over a range of concentrations."

#### THE DUST EXPLOSION PENTAGON

- First of all, what makes dust such a highly combustible fuel source? You're probably familiar with the ingredients necessary to start a fire. They make up what's commonly referred to as the "fire triangle." They are fuel, oxygen and heat.
- When talking about combustible dust, we add two more ingredients: dispersion and confinement. This is what is referred to as the "dust explosion pentagon." In order for a dust explosion to occur, all five of these ingredients must be in place.
- Dust explosions happen when dust fuel is dispersed into oxygen reaching a sufficient level of concentration in an area of confinement and comes in contact with an ignition source: heat.

#### HOW DUST EXPLOSIONS OCCUR

- The scary thing about dust is that it doesn't just burn, it explodes. That's because the more surface area a material has exposed to air, the greater its combustibility. Dust has a much greater surface area than the same material would in a compressed, solid state.

- For example, take a sugar cube. It has a surface area of approximately 13 and a half square centimeters, but break it down into individual crystals and the surface area increases over a thousand-fold.
- Now consider the surface area when you crush those crystals into dust. The finer the dust becomes, the greater the likelihood of it exploding; however, that doesn't mean only very fine dust poses a risk.
- A combustible substance only needs to be 420 microns or smaller to be considered an explosion risk. That's about the size of finely ground table salt.
- An animation produced by the US Chemical Safety Board provides a good example of how a dust explosion can occur in an industrial setting.
- Often, the initial dust explosion might be small; as the dust fuel may be limited to the immediate area around the ignition source; however, once the confined dust fuel reaches a certain level of concentration, the explosion expands and travels through vents and duct work, increasing in strength as it feeds off of the dust fuel that has accumulated in those vents.
- These chain reactions can create shock waves, which shake loose dust that may have accumulated on hidden surfaces such as overhead pipes and rafters, creating an explosion that is often far more severe. This amount of additional dust fuel can be many times greater than that which caused the initial blast.

### **MITIGATING THE RISK OF A CATASTROPHIC DUST EXPLOSION**

- So how do we mitigate the risk of a catastrophic dust explosion? Let's go back to the dust explosion pentagon. Remember each one of those five ingredients must be present for a dust explosion to occur.
- For the purpose of this program, we'll focus on the ingredients that we usually have the most control over. These are fuel (dust accumulation), dispersion (ways in which the dust can be mixed into the air) and heat (ignition sources).

#### **Checking For Dust Accumulation**

- We need to minimize the fuel, the dust, that is available. Be vigilant throughout your daily routine. Keep your work area clean.
- Frequently inspect areas for dust accumulation. It's often the overlooked areas in a facility where accumulation occurs. When possible, check surfaces that are out of normal lines of sight such as the tops of machinery, or overhead pipes, beams and ductwork.
- If you happen to discover specific areas where dust seems to accumulate, inform your supervisor in case additional preventative measures need to be taken.

#### **Preventing Dust Dispersion**

- Engineering control systems such as dust and vapor capture hoods, exhaust vents and other air pollution control systems should be kept clean and free of obstruction.
- The risk of an explosion greatly increases when the dust fuel becomes dispersed in the air. Be sure exhaust and dust collection systems are free of leaks which can re-disperse dust back into the environment.
- Also, check compressed air and vacuum lines for leaks as these can cause localized dispersion.
- Be sure to follow proper procedures for disposing of combustible materials. Never dry sweep or use compressed air to clear away dust.

### **Reducing The Risk Of Ignition**

- Remember when dust fuel is in the air all it takes is one spark. Always be conscious of possible ignition sources such as hot surfaces or sparks from electrical or static discharge.
- Always clear dust from around electrical outlets and make sure power cables are free of nicks or cuts. Know your company's Emergency Contingency Plan, so that in the event of an explosion, you know the correct escape routes, meeting places and other emergency procedures.

### **CONCLUSION**

- Combustible dust is a very real hazard. It's something that can destroy lives. If a dust explosion occurs it very often means severe injuries, burns or death.
- Be aware of the risks, follow safe work practices to mitigate those risks and follow the established emergency contingency plans put in place by your employer.
- If we all follow the precautions and procedures covered in this video as well as specific procedures that may be in place at your facility, we can all go home safely at the end of the day.

## **PREPARE FOR THE SAFETY MEETING**

Review each section of this Leader's Guide as well as the program. Here are a few suggestions for using the program:

Make everyone aware of the importance the company places on health and safety and how each person must be an active member of the safety team.

Introduce the program. Play it without interruption. Review the program content by presenting the information in the program outline.

Copy the review questions included in this Leader's Guide and ask each participant to complete them.

Make an attendance record and have each participant sign the form. Maintain the attendance record and each participant's test paper as written documentation of the training performed.

Here are some suggestions for preparing your video equipment and the room or area you use:

Check the room or area for quietness, adequate ventilation and temperature, lighting and unobstructed access.

Check the seating arrangement and the audiovisual equipment to ensure that all participants will be able to see and hear the program.

## **CONDUCTING THE PRESENTATION**

Begin the meeting by welcoming the participants. Introduce yourself and give each person the opportunity to become acquainted if there are new people joining the training session.

Explain that the primary purpose of the program is to make employees aware of the very real hazard posed by the combustible dust and to discuss precautions and procedures they can take to prevent a catastrophic dust explosion.

Introduce the program. Play it without interruption. Review the program content by presenting the information in the program outline.

Lead discussions about specific areas at your facility where combustible dust may accumulate and the precautions and controls your organization uses to mitigate the risk of a dust explosion.

After watching the program, the viewer will be able to explain the following:

- What the definition of a “combustible dust” is according to the National Fire Prevention Association;
- What the five elements of the dust explosion pentagon are;
- How dust explosions occur;
- What precautions and procedures must be taken to mitigate the risk of a catastrophic dust explosion.

**COMBUSTIBLE DUST AWARENESS  
REVIEW QUIZ**

*The following questions are provided to determine how well you understand the information presented in this program*

Name \_\_\_\_\_ Date \_\_\_\_\_

1. Dusts from metals cannot be combustible.
  - a. true
  - b. false
  
2. What are the three ingredients necessary to start a fire?
  - a. heat, fuel, dust
  - b. heat, dust, confinement
  - c. heat, fuel, oxygen
  
3. How fine does dust need to be before it becomes combustible?
  - a. the thickness of a dime
  - b. the size of a grain of table salt
  - c. the width of a human hair
  
4. Which element is not part of the dust explosion pentagon?
  - a. heat
  - b. confinement
  - c. dispersion
  - d. separation
  
5. In a dust explosion, what acts as the fuel source?
  - a. fire
  - b. heat
  - c. dust
  - d. oxygen
  
6. Dust explosions happen when dust is mixed with oxygen and comes into contact with \_\_\_\_\_.
  - a. heat
  - b. vapor control hoods
  - c. duct work
  
7. What is the term used when dust becomes mixed with oxygen?
  - a. dispersion
  - b. depression
  - c. confinement
  
8. You should only dry sweep combustible dust if you are wearing a dust mask or respirator.
  - a. true
  - b. false
  
9. Compressed air should never be used to clear dust away from electrical outlets.
  - a. true
  - b. false

*ANSWERS TO THE REVIEW QUESTIONS*

1. b

2. c

3. b

4. d

5. c

6. a

7. a

8. b

9. a