COMBUSTIBLE DUST in the TIMBER PRODUCTS INDUSTRY

A GENERAL OVERVIEW

March 2011

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WHAT IS COMBUSTIBLE DUST?

The National Fire Protection Association (NFPA) defines "COMBUSTIBLE DUST" as:

> *"A combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentration, regardless of particle size or shape."*

The definition seems complex, and you'll need to know other definitions to make it clear!

What happens if you "Combust your Dust"?

The result will be an employee injury, fatality, and/or extensive property loss!

WHAT TYPES OF DUST ARE COMBUSTIBLE?

Examples of dust materials that are combustible while suspended in air include:

- Metal dust such as Aluminum and Magnesium,
- Coal and other Carbon dusts,
- Plastic dust and additives,
- Bio-solids,
- Other organic dust such as Sugar, Flour, Paper, Soap, and dried Blood,
- Certain textiles, and
- WOOD DUST!

IS COMBUSTIBLE DUST REGULATED?

It's regulated indirectly through a Federal OSHA [FED-OSHA] "National Emphasis Program" [NEP]!

On March 11, 2008, FED-OSHA published "Compliance Directive CPL 03-00-008". This document contains policy and procedures for enforcement personnel on the evaluation and regulation of combustible dusts.

The Wood Products industry has been inspected under this "Directive" in Federal jurisdiction – Idaho.

State OSHA Plans soon will be "pushed" to adopt the directive and conduct enforcement inspections under it.

"The Directive"can be located at:

www.osha.gov/OshDoc/Directive_pdf/CPL-03-00-008.pdf


UNITED STATES DEPARTMENT OF LABOR

OSHA INSTRUCTION

WHAT IS THE BASIS OF THE "COMPLIANCE DIRECTIVE?"

The directive lists existing codes & standards that, when taken together, list the safe practices needed to prevent a fire, deflagration, or explosion hazard. These include:

- National Fire Protection Association (NFPA) Code specifications, for various items such as engineering controls, explosion venting, etc.
- Occupational Safety & Health Administration (OSHA) Standards under Title 29 of the Code of Federal Regulations (29 CFR) for:
- Housekeeping (29 CFR 1910.22)– to assess dust accumulation.
- Electrical Standards (29 CFR 1910.303+) – to assess locations for "Hazard Class", equipment grounding issues, etc.
- General Duty Clause (Section 5(a)(1) of Public Law 91-596, requiring employer actions for known hazards in the absence of a specific standard.

DOES THE “COMPLIANCE DIRECTIVE” APPLY TO THE TIMBER PRODUCTS INDUSTRY?

YES!

OSHA Compliance Safety & Health Officers (COSHOs) are required to evaluate the presence of conditions such as accumulating wood dust In this industry!

Methods for compliance officers to “Evaluate” the hazard, including material sampling procedures for laboratory testing, are listed.

At present, INDICATORS of hazard are all that is necessary to sustain an allegation of a hazard.

Therefore, conditions subject to the “Directive” must be recognized and controlled. Doing that will prevent an injury, fatality, and/or property loss, and an unfortunate regulatory experience!

We will discuss HAZARD IDENTIFICATION and METHODS OF CONTROL, so you can AVOID the unthinkable!

WHEN WILL THERE BE A SPECIFIC OSHA COMBUSTIBLE DUST STANDARD?

That's unknown at this time – but they're working on it!

In the absence of a standard, the "compliance directive" (which contains parts of other standards) IS in effect.

To prevent problems, we'll need to:

1. DEFINE the HAZARDS.
2. EXPLAIN what Codes and standards apply.

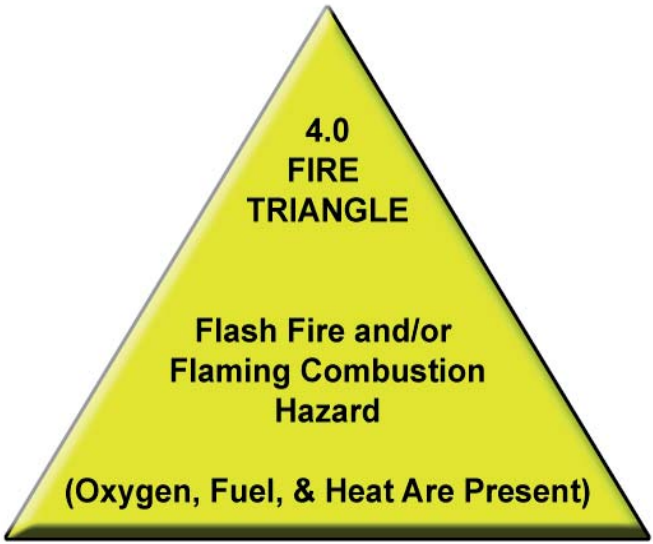
HAZARDS RELATED TO COMBUSTIBLE DUST

In INCREASING ORDER of occurrence and severity, the hazards are:

1. FIRE
2. DEFLAGRATION
3. EXPLOSION

Here's some USEFUL detail on each condition…

FIRE TRIANGLE



A Flash Fire or Flaming Combustion Hazard results when there is:

- OXYGEN (air),
- FUEL (wood dust) on any surface or in the air, AND,
- HEAT (a source of ignition).

Sources of ignition include, but not limited to:

- Overheated equipment bearings,
- Open flame, sparks,
- Hot metal fragments, welding activity,
- Electrical shorts, static electricity discharges,
- Forklifts in the area NOT RATED for use in combustible dust areas
- Space heaters, heat guns, and similar conditions or devices.

DEFLAGRATION

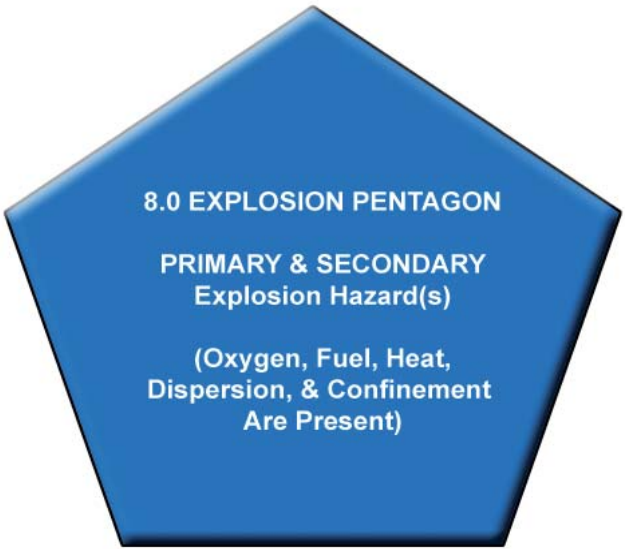
A "DEFLAGRATION" occurs when you have:

In other words, "FIRE TRIANGLE" conditions where there's a "cloud" of wood dust that is small enough to become and remain airborne.

At some airborne concentration, a "DEFLAGRATION" may occur.

A "DEFLAGRATION" is essentially a "subsonic" explosion – you can see it expand as the pressure rises.

EXPLOSION PENTAGON



An "EXPLOSION" occurs when you have:

+ Confinement of wood dust in air

In other words, “Deflagration” conditions where there’s a “cloud” of wood dust that is small enough to become and remain airborne, AND,

It’s **UNDER CONFINEMENT** within collection ductwork, silos, storage bins, bag houses, and other enclosed structures.

An **“EXPLOSION”** is a “supersonic” pressure rise – it’s faster than the speed of sound.

MANAGEMENT’S ROLE - HOW ARE HAZARDS PREVENTED?

Fortunately, the controls are simple, and they include the following:

- NFPA – Follow Applicable Codes! In the following slides, you’ll be shown the SPECIFIC codes that relate to control of conditions.
- HOUSEKEEPING – An OSHA standard that is used to control wood dust accumulations.
- ELECTRICAL – A series of OSHA standards that are used to control sources of electrical ignition.
- CREATE a documentation record - YOUR administrative method of documentation that tracks and proves your clean-up efforts.
- The EMPLOYEE Role is critical! – It’s the way you have to quickly recognize and control combustible dust accumulations and control.

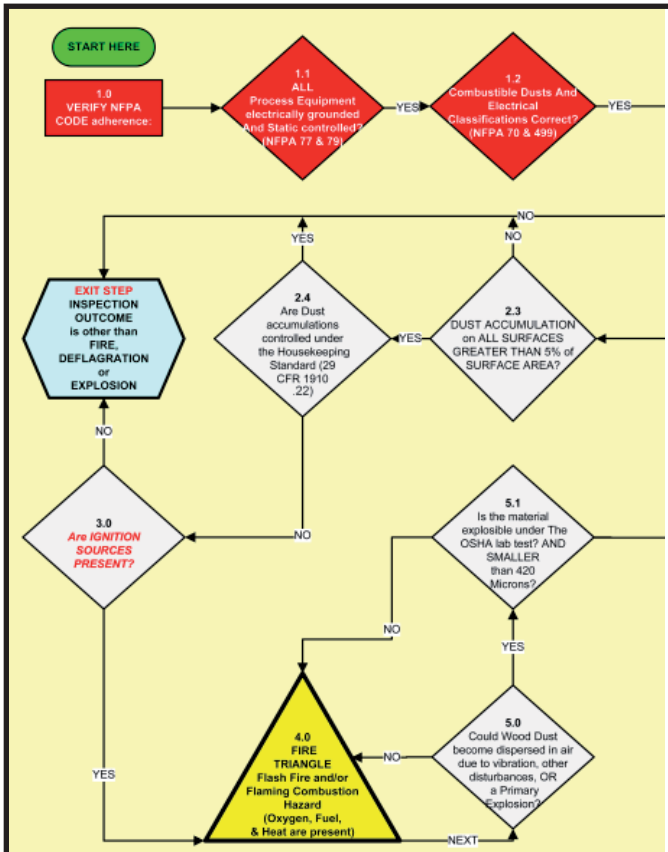
EMPLOYEE'S ROLE - HOW ARE HAZARDS PREVENTED?

Fortunately, the controls are simple, and they include the following:

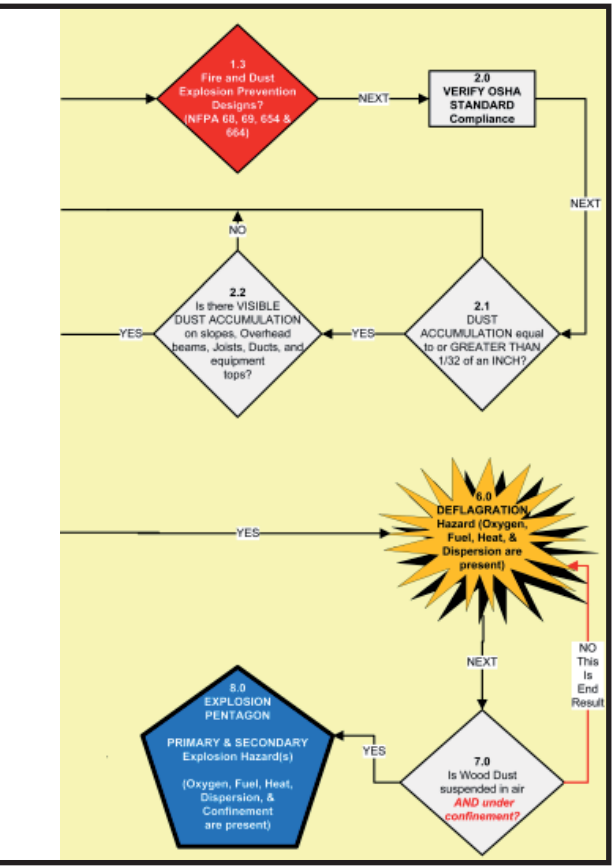
- Inspect your work area FREQUENTLY! - Make certain you follow supervision's directions on the frequency of clean-ups!
- Look for and control ignition sources – You know your area best, and you know when and how "things just aren't right".
- ELECTRICAL – Control sources of electrical ignition. Damaged conduit, sparking equipment, etc need to be rapidly reported and repaired.
- COMPLETE all documentation records required by supervision.

The Combustible Dust EVALUATION PROCESS is SUMMARIZED in a simple flowchart - each process will be extracted and explained.

FLOWCHART - EVALUATION & CONTROL OF COMBUSTIBLE DUST



Each STEP will be EXTRACTED and EXPLAINED.
Please remember – This is an OVERVIEW!



FOR EVALUATIONS of NFPA CODES, a primary example of what's needed will be given, but additional detail requires referral to the individual NFPA Code.

STEP 1.0 –

The current “Compliance Directive” lists the applicable National Fire Protection Association (NFPA) Codes.

NFPA is a code setting organization whose resulting publications are “adopted by reference” by regulating entities.

In the case of OSHA, they’re used as a “benchmark” to evaluate existing controls against “optimal” specifications.

The applicable (NFPA) Codes include the following:

- NFPA 68 – Standard on Explosion Protection by Deflagration Venting.
- NFPA 69 – Standard on Explosion Prevention Systems, 2008 Edition.
- NFPA 70 - National Electrical Code, 2008 Edition.
- NFPA 77 – Recommended Practice on Static Electricity, 2007 Edition.
- NFPA 79 – Electrical Standard for Industrial Machinery, 2007 Edition

(NFPA) Codes also include the following:

- NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Non-Combustible Particulate Solids, 2010 Edition.
- NFPA 499 – Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.

- NFPA 654 – Standard for the Prevention of Fire and Dust Explosions from the manufacturing, Processing, and Handling of Combustible Particulate Solids, 2006 Edition,
- NFPA 664 – Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.

Additional NFPA Codes that might apply in the Timber Products industry that are NOT included here are the following:

- NFPA 85 - Standard for Boiler and Combustion Systems Hazard Code (2007 Edition).
- NFPA 86 – Standard for Ovens and Furnaces.
- NFPA 2113 – Standard on Selection, Care, Use, and maintenance of Flame Resistant Garments for Protection of Industrial Personnel Against Flash Fire.

There are other codes that apply to other types of industries.

SPECIAL NOTE ON NFPA

NFPA Codes are lengthy, detailed, and complex!

These Codes have TWO types of CONTROL METHODS, which are either:

- Performance Based – which basically means “it gets the job done” OR
- Prescriptive based – which basically means that specific design requirement(s) are identified that “get the job done.”

Codes apply to new construction and new processes within existing operations, AND,

The Codes are not “retroactive” UNLESS, the authority having jurisdiction REQUIRES some or all parts of it to achieve the safety objective! In that case, they DO APPLY!

NFPA Codes are lengthy and detailed! In PART 2, you’ll receive:

- GREATER detail on code requirements, with specific industry examples.
- SUMMARIZED, relevant information in a “checklist” format, useable for a facility walk-through evaluation.

However, the MAIN FOCUS of each NFPA code will be identified.

At least you’ll know what you’re up against!

STEP 1.1 –

- NFPA 77 – Recommended Practice on Static Electricity, 2007 Edition

  Main Focus – Check process equipment in wood dust areas.

  Is there generation, accumulation, and discharge of static electricity? IF YES, institute controls.

  How It Impacts Your Operation – This code contains information to assist you identifying and assessing the hazards of static electricity. Some practical examples include using and grounding metal ducting to earth, and NOT using PLASTIC materials as ductwork!

- NFPA 79 – Electrical Standard for Industrial Machinery, 2007 Edition

  Main Focus – This code applies to electrical and electronic equipment and industrial machinery systems operating at 600 Volts or less that are NOT in Hazardous Locations.

  Does equipment conform to current standards? IF NO, institute controls.

  How It Impacts Your Operation – Equipment that does not meet requirements are potential sources of ignition!

STEP 1.2 –

- NFPA 499 – This code applies to “locations where combustible dusts are produced, processed, or handled, and where dust released into atmosphere or accumulated on surfaces could be ignited by electrical systems or equipment” (NFPA)

  Main Focus – Check your process equipment areas:

  Are dusts being produced there? Is there electrical equipment in the area?

  How It Impacts Your Operation – Areas producing a level of fine, airborne wood dust where there is electrical equipment, such as motor control centers may require special protection.

- NFPA 70 - National Electrical Code, 2008 Edition

  Main Focus – This code specifies the “practical safeguarding of persons and property from hazards arising from the use of electricity”. (NFPA)

  How It Impacts Your Operation – Open breakers, uncovered local disconnect switches, or equipment that is in poor repair are possible sources of ignition.

  This code should be used to determine acceptable practice in case of a question.

  You should know, this particular code runs 822 PAGES.

STEP 1.3 –

- NFPA 68 – Standard on Explosion Protection by Deflagration Venting

  Main Focus – This code defines requirements for effective deflagration venting for enclosures where it's possible for a deflagration to occur.

  How It Impacts Your Operation – Do you have process equipment such as:

  Hoppers or silos that accept combustible dusts collected from and conveyed away from the process areas?

  Is it possible for a deflagration to occur within them?

- NFPA 69 – Standard on Explosion Prevention Systems, 2008 Edition

  Main Focus – This code describes minimum system requirements for installing systems for the prevention of explosions in enclosures that contain flammable concentrations, including dusts.

  It also covers "pre-deflagration" detection or control of an ignition. This can be required by the local authority having jurisdiction (AHJ).

  How It Impacts Your Operation – Your system may have been installed in prior years, and that system may have met code requirements in effect at that time.

  However, if the local AHJ believes you NEED these systems, you can be required to upgrade and install them as required in the code!

- NFPA 91 – Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Non-Combustible particulate Solids, 2010 Edition.

  Use this standard to control Non-Combustibles ONLY IF NFPA 68 & 69 Do Not Apply!

- NFPA 654 – Standard for the Prevention of Fire and Dust Explosions from the manufacturing, Processing, and Handling of Combustible Particulate Solids, 2006 Edition.

  Main Focus – This code, OR NFPA 664 (described next) applies to specific types of industry. You need to check with NFPA 664 First. If you're covered there, you're exempt here.

  How It Impacts Your Operation – Check your process equipment areas:

IF COVERED, per NFPA, this code:

- Applies to all phases of the manufacturing, processing, blending, pneumatic conveying (dust in an air duct); and,
- Handling of combustible particulate solids or hybrid mixtures, regardless of concentration or particle size;
- Where the materials present a fire or explosion hazard.

Are there systems that:

- Convey (and confine) wood dust, that,
- DO NOT HAVE control systems such as spark arrestors, or deflagration vents to prevent dust ignition and direct away any pressure rise?
- If so, you may be required to provide controls!
- NFPA 664 – Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking.

Main Focus – VERIFY if your operation is one or more of the following.

Do you process wood or manufacture wood products because your operation performs or makes:

- Wood flour, (dust, particles),
- Industrial woodworking,
- Furniture,
- Plywood,
- Composite boards,
- Is a Lumber mill,
- Is a Production type woodworking shop, OR,
- Is a Carpentry shop incidental to facilities NOT CLASSIFIED by this code?

Does your operation:

- Use wood or other cellulosic fiber as a substitute for or additive to wood fiber, OR,
- Process wood, create wood chips, particles, or dust?

IF you answered YES to one or more of these questions, your operation is covered by NFPA 664 but NOT NFPA 654.

How It Impacts Your Operation – Once you defined how you're covered by code, you'll need to check IF you need to meet its requirements.

For NFPA 664 this means:

- You're covered if you have more than 5000 square feet of operations, AND

- Your dust collection system is required to operate at 1500 cubic feet per minute.

STEP 2.0 –

After checking your location's NFPA Code status, there's still a possibility that a HAZARD can develop if a particular set of circumstances are present, or can develop.

STEP 2.0 needs to be done to VERIFY if any conditions prohibited by the OSHA standards listed in the "Compliance Directive" exist.

STEP 2.1 –

Housekeeping under 29 CFR 1910.22

Main Focus - Walk through the area at several times of the day, and look for the presence of wood dust accumulation. Ask yourself the following questions:

1. Are there any accumulations of wood dust that are greater than 1/32 of an inch? IF YES, one of the compliance conditions may exist.
2. WHEN will this be cleaned up? IF it will be some time, this will allow material build-up.

How it impacts your operation.

CAUTIONARY NOTE: The accumulation of "wet" dust may seem unimportant. However, under current Federal practice, this does MATTER. Dust material will be collected for laboratory testing. But the dust wetness (% moisture) DOES NOT EXEMPT your location!

STEP 2.2 –

Main Focus - While walking through the area at several times of the day, looking for the presence of wood dust accumulation, ask yourself the following questions:

1. Is there VISIBLE DUST ACCUMULATION on slopes, overhead beams, joists, ducts, and equipment tops?
2. Are these areas ever cleaned up? IF it will be some time, this will allow material build-up.
3. Are there engineering controls, such as installing sloped surfaces, that will minimize dust accumulation?
4. How it impacts your operation? The accumulation of materials in these areas CAN BE SHAKEN LOOSE by a PRIMARY EXPLOSION, and this can result in a SECONDARY EXPLOSION.

STEP 2.3 –

Main Focus - While walking through the area at several times of the day, looking for the presence of wood dust accumulation, on ALL SURFACES, ask yourself the following questions:

1. Is there TOTAL DUST ACCUMULATION equal to or greater than 5% of the total square footage?
2. IF YES, the presumption under current Federal compliance practices is that there is reason to believe that “combustible Dust” is present in sufficient quantity to pose a hazard of “deflagration.”

How It Impacts Your Operation - It is assumed that such material will become disturbed and therefore airborne. Particle size is expected to be highly variable, and it's assumed that there will be enough of the small particles present to result in a Deflagration hazard.

STEP 2.4 –

Main Focus - While walking through the area at several times of the day, looking for the presence of wood dust accumulation, on ALL SURFACES, and finding that you have equal to or greater than 5% of the surface area covered, ask yourself the following questions:

1. Do I take steps to CLEANUP & CONTROL the accumulation?
2. Is the CLEANUP & CONTROL occurring DAILY?
3. Is the cleanup & control assigned to an accountable person, AND, is it DOCUMENTED?

How It Impacts Your Operation - Under current Federal inspection criteria, if you can't prove you did it, you DIDN'T do it! You DO need to track it!

STEP 3.0 –

Now let's assume that you actually DO HAVE DUST PROBLEMS! What now?

Main Focus - CHECK OSHA Electrical Standards at 29 CFR 1910.303 – in several following sections beginning at Section .303, electrical requirements are specified for various types of equipment. The listings within are:

- The primary items looked for in an OSHA Inspection.
- Directly related to possible sources of ignition; AND,
- They're only a small part of the requirements contained by NFPA 70 – National Electric Code (about 822 pages)!

How It Impacts Your Operation – the presence of these conditions will be a source of ignition, either directly at the dust accumulation, or by transport of hot fragments or particles through ductwork or other process equipment.

Are there any:

1. Non-permit controlled "Hot Work"? This could be a source of hot metal fragments.
2. Electrical devices such as heat guns? dryers, space heaters? electric tools?
3. Open flame, BBQ pits, matches, matchless lighters?
4. Forklifts not rated for the combustible dust area?
5. Cigarette (or other smoking material) residues?
6. Ungrounded, shorting electrical equipment, or electrical equipment in poor condition?

STEP 4.0 –

Here's a known equation with a known solution:

DUST (fuel) + Oxygen (Air) + HEAT (ignition source) = FIRE TRIANGLE

DUST + OXYGEN + HEAT = FIRE TRIANGLE

(fuel) (air) (ignition source)

At this point, if you have ALL OF THESE CONDITIONS, you are at Risk of a FIRE, at the very least!

STEP 5.0 –

THIS STEP IS CRITICAL! Take a hard look at your location…

- COULD wood dust become dispersed in air?
- A PRIMARY explosion could do it, so could a source of vibration, such as:
- A shaker table,
- Conveyor belt,
- Chipper,
- Drive motor, or similar equipment.

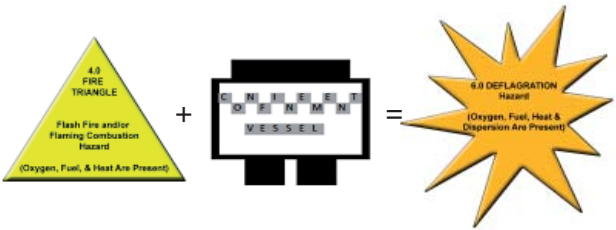
STEP 5.1 –

- Is the wood dust, “Explosible”? Under current OSHA laboratory test procedures, it is almost certain to be “Explosible”. The reason is that samples are obtained, dried, then ignited in a closed laboratory “Test Chamber”.
- No one expects you to determine the size of wood dust particles, but you need to know that wood processes typically generate a wide range of particle sizes.
- The SIZE that is required for airborne and “Explosible” dust is typically 420 microns (420 millionths of a meter)!
- Assume this particle size exists – OSHA DOES!

STEP 6.0 –

IF the material is dispersed in air, you have the following:

- FIRE TRIANGLE + DUST (Suspended in Air) = DEFLAGRATION



FIRE TRIANGLE + DUST = DEFLAGRATION
(suspended air)

SO, IF engineering control measures are NOT WORKING, or were NEVER PRESENT, you are at risk of a DEFLAGRATION!

STEP 7.0 –

There's ONE MORE step you need to be concerned with – Take a HARD LOOK at your operation and ask yourself, is this material UNDER CONFINEMENT?

Confinement means being located INSIDE of Bag Houses, Ductwork, Silos, Cyclones, Hoppers, Tanks, and similar structures.

IF SO, what it means is that the dust can become so concentrated in air that pressure cannot easily be relieved. A deflagration may become an EXPLOSION. Essentially, its like a BOMB.

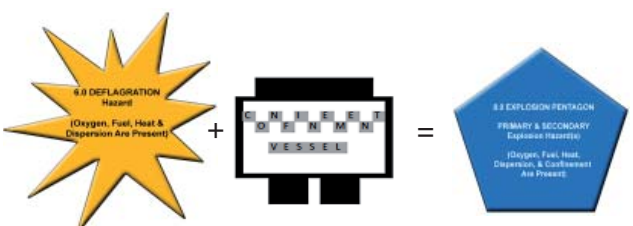
Explosive pressures can destroy:

- Windows,
- Building sheet metal,
- Ductwork,
- Electrical conduit, and
- PEOPLE!

STEP 8.0 –

IF the material is dispersed in air, you have the following:

- DEFLAGRATION + CONFINEMENT (Within a vessel) = EXPLOSION PENTAGON



DEFLAGRATION + CONFINEMENT *(within a vessel)* = EXPLOSION PENTAGON

SO, IF engineering control measures are NOT WORKING, or were NEVER PRESENT, you are at risk of an EXPLOSION!

NEXT STEPS -

You probably have a BETTER UNDERSTANDING on what HAZARDS your location faces in terms of FIRE, DEFLAGRATION, and EXPLOSION.

You are encouraged to BEGIN evaluating your own location to EVALUATE your RISK.

Combustible Dust is a

SERIOUS ISSUE!

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