DUST COLLECTION TRAINING

Revision 2013

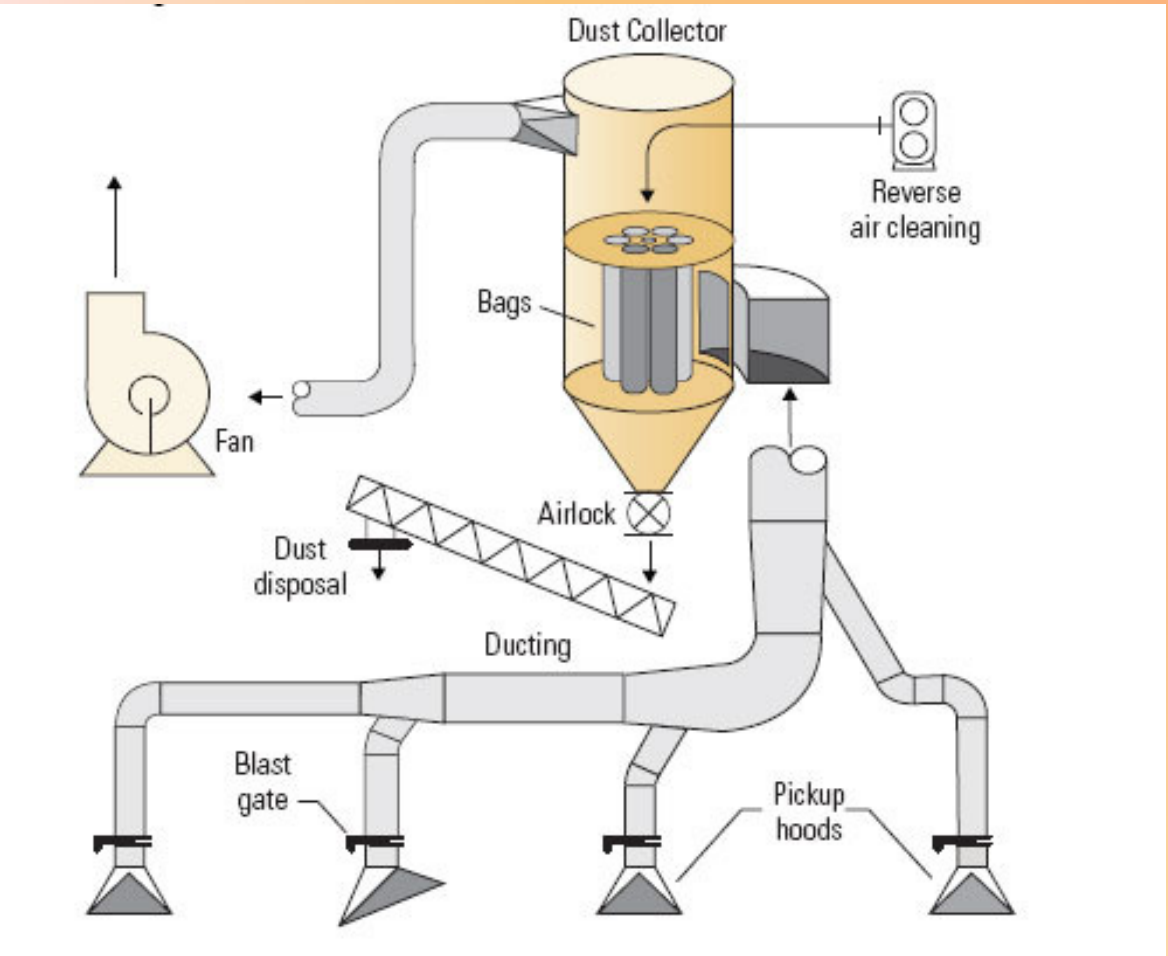
TOPICS

1. Why does a school need a dust collector?
2. What is a dust collection system?
3. What are the maintenance requirements?
4. What are the hazards?

WHY

- *NFPA 664 Section 1.1.2*
  - Applies to all woodworking operations that occupy areas of more than 465 m^2 (5000 ft^2) or where dust producing equipment requires aggregate dust collection flow rates of more than 2549 m^3/hr (1500 ft^2/min)
- Occupational Health and Safety dust levels
- Prevent secondary explosions
- Maintain a clean working environment
- Everyone has the right to work in a safe and healthy environment.

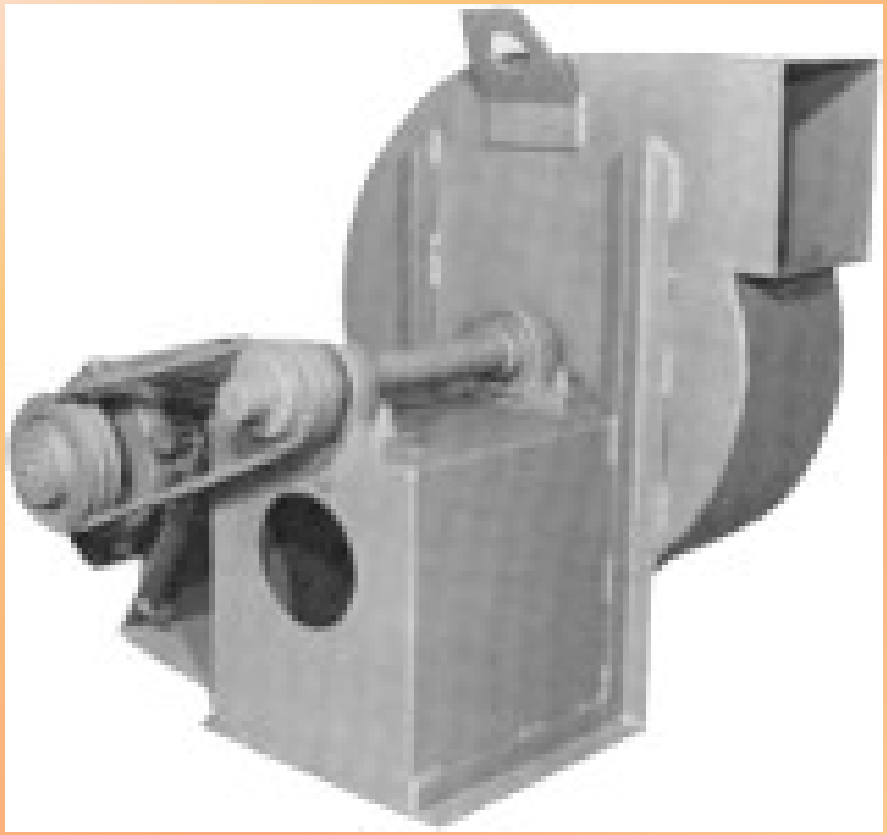
DUST COLLECTION SYSTEM



DUST COLLECTION SYSTEM

- Fan
  - Provides the power to enable the system to operate
  - Provides the motive energy to move contaminated air from the dust producing source to the dust collector
  - The fan consists of a wheel or rotor, mounted on a shaft that rotates in a scroll shaped housing
  - Air enters at the center, or eye of the rotor, and makes a right angle turn, and is forced through the blades of the rotor by centrifugal force in to the scroll shaped housing
  - The fan and motor are the units which dictate both the capture and transport velocities, based on the system losses (*static pressure)*

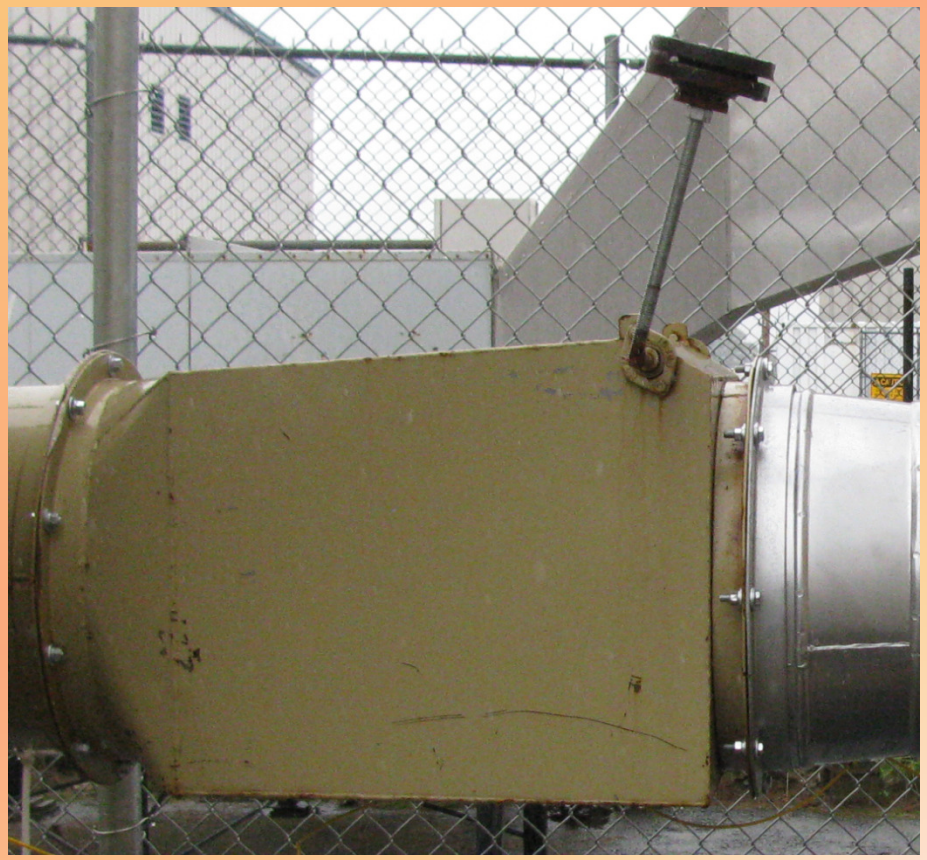
DUST COLLECTION SYSTEM



Fan

DUST COLLECTION SYSTEM

- Backflow Preventor
  - Inserted in the dirty air inlet into the dust collector
  - Actuated by the force of the explosion through ductwork and moves a gravity operated flap to divert the fire ball back to the dust collector
  - Prevents the fire ball created by the explosion from being transported back along the ducting to the place of work



DUST COLLECTION SYSTEM

- Dust Collector (Bag House)
  - An air filtration device, utilizing fabric filter bags for removing solid particulates from an air stream. Dust particles are transported to the bag house via conveying ducts.
  - Dust laden air enters the dust collector, the particles are separated from the air-stream in two ways:
    - The heavier particles fall out of suspension due to the reduced air velocity (*transport velocity failure*) and collect within the bottom of the hopper.
    - The lighter particles are separated from the air-stream as they pass through the filter media.
  - Dust collects in the collector bins under the dust collector.

DUST COLLECTION SYSTEM

DUST COLLECTION SYSTEM

- Filter Media
- Woven filter bags are used mainly
- The air to cloth ratio is the quantity flow rate of air in cubic feet per minute divided by the area of the filter fabric in square feet
- The air to cloth ratio is the largest contributing factor, to the size of the bag-house and consequently the space required for installation

DUST COLLECTION SYSTEM

- Ducting
  - Ducting is the roadway by which the captured dust is transported to the bag-house
  - Air velocity within the duct from the hood to the bag-house is maintained at the point to which it is designed. (*transport velocity*)
  - If the transport velocity is not maintained dust will collect in the ducting
  - Losses in the ductwork which also affect the dust collection system effectiveness can be attributed to the size and material type of the duct, type and number of elbows, tees, wye branches, valves, bends or any other type of ductwork deviation from the norm
  - SMACNA codes should be used for all ductwork design
  - The ductwork is comprised of all ductwork used for the transportation of both dirty air to the bag-house and clean air from the bag-house, through the fan and release to atmosphere
  - Ducting will have inspection doors for inspecting the interior of the ducting

DUST COLLECTION SYSTEM

DUST COLLECTION SYSTEM

- Spark Detection System
  - An electronic device located in the air stream between the work space and the dust collector, its primary function is to alert a spark detection system, located in the ductwork, and discharge a suppressant to extinguish the fire, spark or smoldering embers before it gets to the dust collector and causes a major fire or explosion.

DUST COLLECTION SYSTEM

- Abort Gate
  - Work in conjunction with the spark detection system
  - Typically only installed when air is being recycled into the building
  - When a spark is detected in the ducting the spark detection system will trigger the abort gate to open and diverts the normally recycled air outside. Thus in the event of a spark making it through the system and causing a fire or explosion the fire or explosion will not be recycled back into the building.
  - Some abort gates are automatically reset to the recycle position, but most are a manual reset requiring a lever or arm to be flipped.

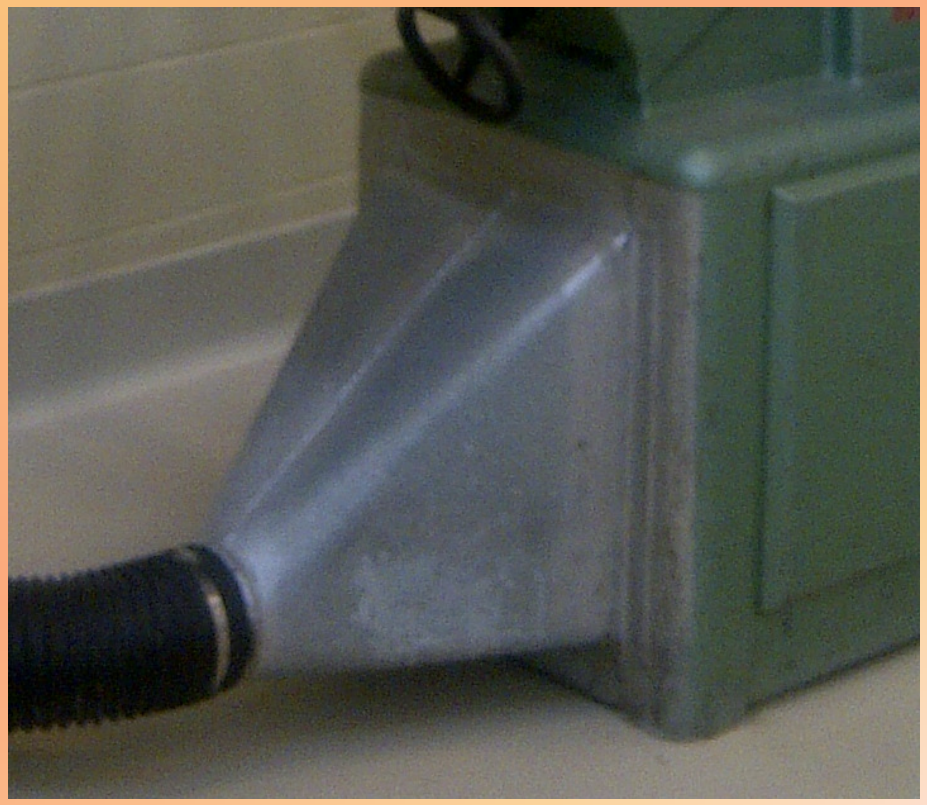
DUST COLLECTION SYSTEM

- Blast Gates
  - Located one the ducting before the hood
  - Controls the air flow to the hood
  - Set and marked for the required air when system was balanced
  - NEVER to be moved

DUST COLLECTION SYSTEM

- Hoods
  - Located at the point or points where dust filled air are released from a machine tool into the ductwork for transportation to the bag-house
  - Must capture the dust emissions in an efficient manner to prevent/reduce worker exposure to dusts
  - The exhaust hood:
    - Partially (as much as possible) encloses the dust-producing operation
    - Captures dust particles and guides dust-laden air efficiently
  - The design of the exhaust hood requires sufficient knowledge of the process or operation so that the most effective hood or enclosure can be installed
  - The hood is designed to reflect its ability to capture dust from the source without release to the general atmosphere, the energy necessary to create this force is termed *capture velocity*
  - Hoods come in many different shapes and designs depending on the operation, a rule of thumb design for these hoods can be found in the Industrial ventilations manual
  - Dust source is to be as completed enclosed as possible for hood efficiency to be at its best

DUST COLLECTION SYSTEM

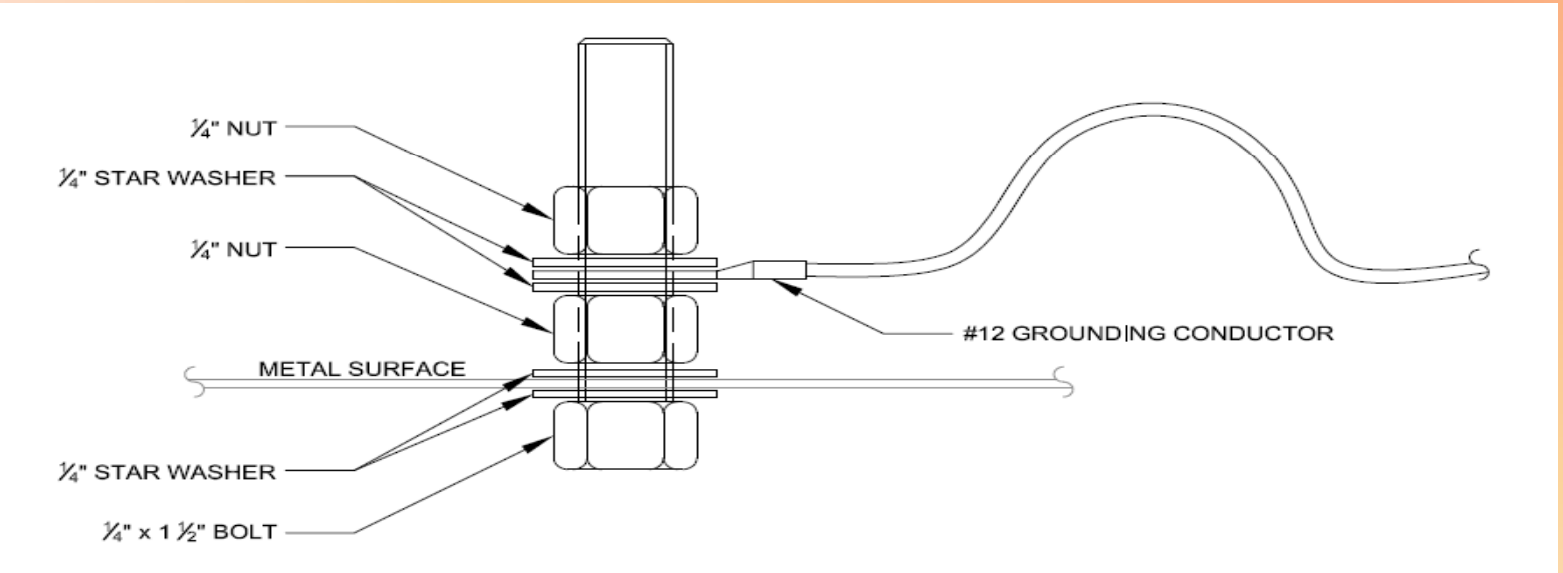


DUST COLLECTION SYSTEM

- Bonding/Grounding
  - Use of a grounded conductive material between fittings to eliminate static electrical charges
  - A path to allow electric potential to travel to ground
  - Use of a grounded conductive material between fittings to eliminate static electrical charges
  - Equipment on the ends of the ducting system must be connected to ground *(grounding rod)*
  - All components of the dust collector (filter cages, bags, ductwork, housings etc) must be grounded and bonded as per **NFPA 77**
  - The filter media must have a static dissipative cuff so that other bonding is secondary, and tested to ground $<10^8$ ohms

DUST COLLECTION SYSTEM

- Bonding/Grounding



Example of Grounding Lug

DUST COLLECTION SYSTEM

- Level Sensor
  - An electronic measuring device that monitors the waste level in side the bag-house hopper
  - Ensures the waste level does not reach the site of the filter media and explosion vents/doors making them ineffective, or any other safety device within the bag-house
  - If the level sensor is tripped it will shut the dust collector and fan down

DUST COLLECTION SYSTEM

- Pressure Gauge
  - Indicates the pressure difference from the dirty side to the clean side of the dust collector
  - The intent to give an optical viewing of the state of the filters in terms of differential pressure
  - Low pressure indicates that the dust collector is working according to design, or lower than design may indicate a bag has come loose or is burst
  - High pressure indicates the filter media is beginning to plug and may need cleaning, inspection is required in both too high or too low cases

DUST COLLECTION SYSTEM

- Explosion Vents/Doors
  - Low burst pressure surfaces calculated for a area fixed over an opening on the structure to be protected
  - In the event of a deflagration the vents provide a rapid and unrestricted opening at a predetermined burst pressure (Pstat) allowing combustion gases to expand and flow through the open vent
  - The required relief area necessary to protect the surroundings is determined by using the most current standards of **NFPA 68**
  - The explosion door should not be covered or impede under ANY circumstances

DUST COLLECTION SYSTEM

Explosion Door

Explosion Vent

DUST COLLECTION SYTEM

- Blast Zone
  - A segregated area, usually fenced, to ensure the blast zone is un occupied by people and material
  - The fan exhaust should also discharge into the blast zone
  - Required where explosion vents/doors are present
  - There to protect people, property and equipment

DUST COLLECTION SYSTEM

Blast Zone

MAINTENANCE AND INSPECTION

MAINTENANCE AND INSPECTION

- Why is recording maintenance and inspections important?
  - Without proof of maintenance (records) shop could be shut down by the inspector
  - Keeps the system running to the design parameters
  - Required by NFPA

MAINTENANCE AND INSPECTION

- All equipment and parts of the dust collection system require maintenance
- All maintenance and inspection schedules have been outlined by DOE in documents kept in the wood shop

HAZARDS

HAZARDS

- Dirty work environment
- Cause respiratory distress and issues
- Various wood dusts have been directly linked to lung disorders
- Explosions, or worse secondary explosion

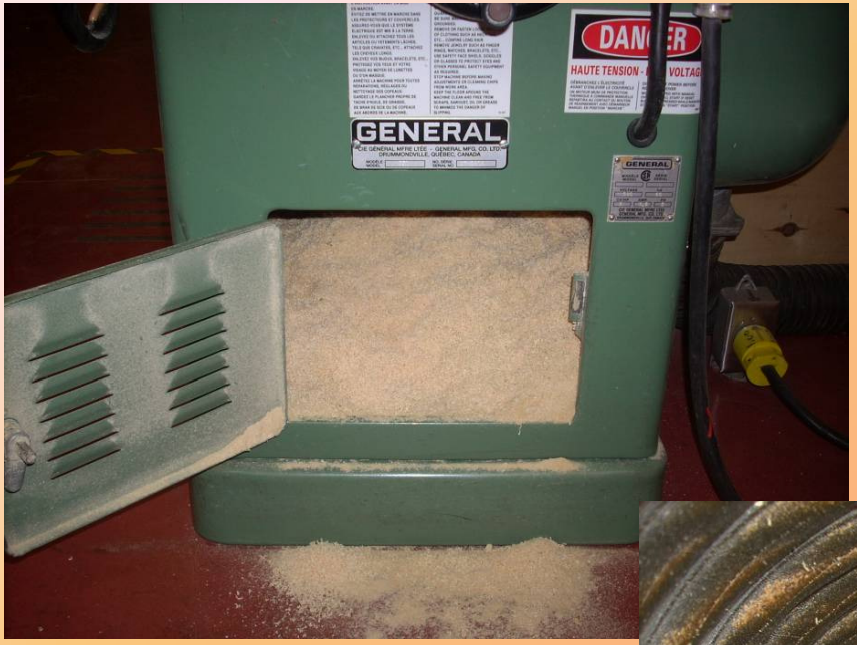
HAZARDS

- How much dust is too much?
  - NFPA 654 Section 6
  - NFPA 664 Section 4
  - 1/8” over 5% of the area of 1000 sq.ft
  - Thickness of a paperclip or dime
  - Write your name in it or see your foot print
  - When you cannot tell the colour of the surface

HAZARDS

Result of Improper Dust Collection Systems

HAZARDS



HAZARDS

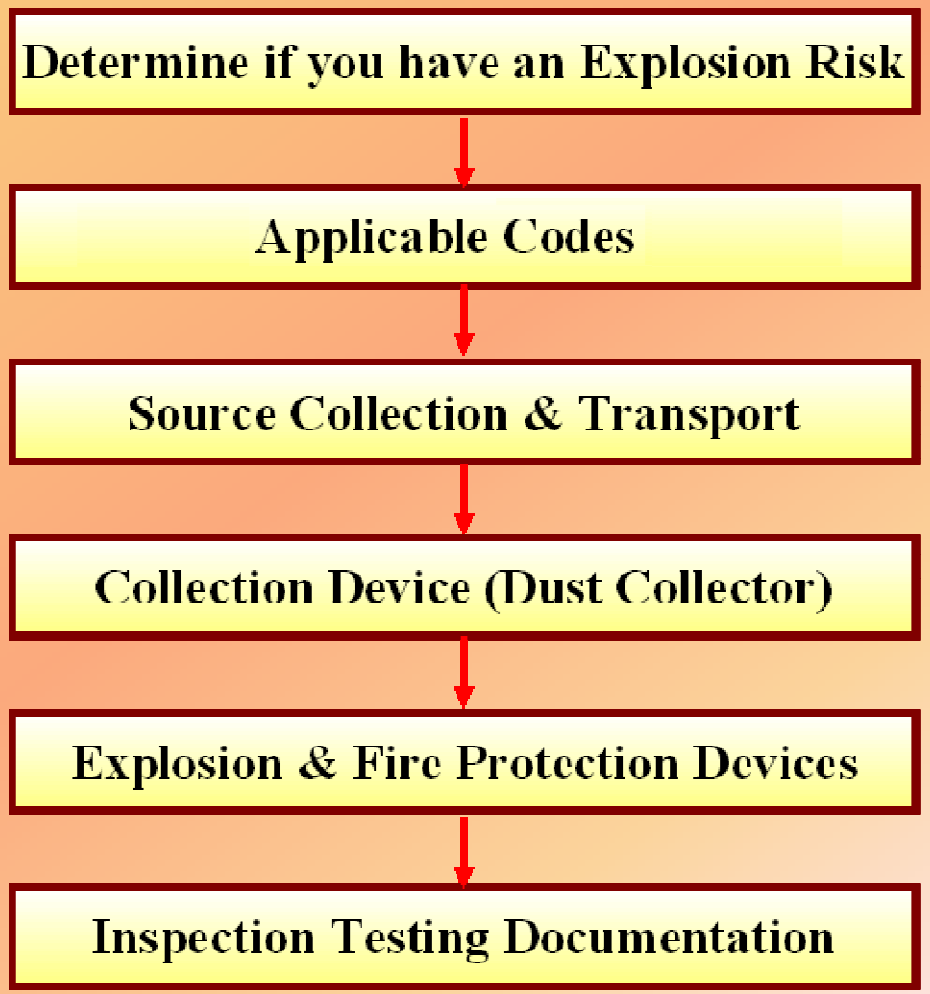
- Explosion Risk
  - For an explosion to occur the following requirements are needed:
    - Fuel (Dust)
    - Ignition Source (Spark)
    - Suspended Fuel
    - Confinement of Fuel
    - Oxidant (Air)

HAZARDS

- If an explosion occurs, and there is more fuel laying around the shop, the first explosion will cause this dust to become airborne and create a secondary explosion. This is the importance of having a clean working environment

HAZARDS

- When an explosion occurs it will because there was a problem with one of these six factors



HAZARDS

- Wood dust is more explosive than coal dust.
- Result of a wood dust explosion.

Lakeland Mill Prince George BC May 2012

QUESTIONS?