

Industrial Ventilation: It's not just Blowing Smoke!

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InDUSTrial Ventilation It could be called this

Abstract

- Abstract: People have needed smoke and dust free workspaces since the beginning of time. The Industrial revolution introduced powered machinery with a surge in dust production which led to diseases such as black and brown lung – and later on asbestosis and mesothelioma. Various solvents were also identified as poisons and carcinogens as well. The capabilities of the industrial ventilation specialist are now much greater than they were in the days of the smoke blowers of the early 20th century. From dust control of industrial kilns & furnaces to laminar flow benches for semiconductor fabrication to clean rooms and controlling hazardous mists and vapors, we ensure the safety and comfort of the workforce, cleanliness of the products, and environmentally benign facilities.

Introduction

- **Washington State Dept. of Labor & Industries Definition:**
- Industrial ventilation is a method of controlling worker exposure to airborne toxic chemicals or flammable vapors by exhausting contaminated air away from the work area and replacing it with clean air. It is one alternative to control employee exposure to air contaminants in the workplace. Other alternatives include process changes, work practice changes, substitution with less toxic chemicals, or elimination of the use of toxic chemicals. Industrial ventilation is typically used to remove welding fumes, solvent vapors, oil mists or dusts from a work location and exhaust these contaminants outdoors.
- *The design and troubleshooting of industrial ventilation systems should be handled by a qualified ventilation engineer or firms specializing in this field.*

Hemeon's Definition

- Plant and Process Ventilation, 1955
- "Industrial Ventilation is concerned largely with engineering techniques for controlling air currents within the plant and for introducing outdoor air in a pattern and on a scale that is just adequate to maintain satisfactory air purity without excessive waste of heated (or cooled) air." My addition is emphasized

Basic Design Requirements

- Clean & Safe Environment for workers
- Comfortable Environment for workers
- Protect products and process from dusts, mists, fumes, vapors, gaseous hazards
- It ain't **JUST** HVAC!

Basic Definitions

- Fume – suspension of microscopic droplets and/or grains – at or near condensation to solid phase – Smoke is a sub-case of Fume
- Mist – dispersion of droplets near the saturation line – near the dew point
- Dust – fine, granular particulate matter
- Aerosol – a dispersion of particles/droplets in air

Basic Assumptions:

- All Types of Plumes may be considered as hard spheres for collection by hoods
- Filters differ between dusts, mists, vapors, gases
 - Dusts are dry
 - Mists are damp – possibly corrosive
 - Vapors can be saturated or superheated
 - Gases can be condensible or non condensible, combustible or non flammable

An Early Form of Industrial Ventilation

- Open Hearth with an Open Smoke Hole
- Little difference between a Kitchen and a Forge and a Pottery Kiln!



Add a Chimney or Smokestack

- Uses the buoyancy of the smoke to exhaust the hearth, induces a draft
 - Why Victorian houses are so chilly & drafty
 - Makeup air can be cold!

“Modern” Building Ventilation



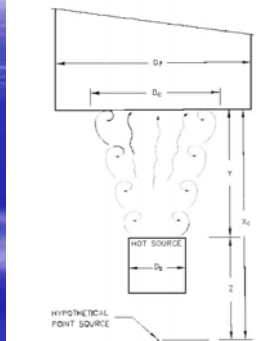
- Thermal or “Gravity” Ventilation
 - Natural Convection
 - Lower Cost
 - Difficult to Filter

“Modern” Building Ventilation 2



- Forced Supply, Thermal Vent
 - Can condition supply air
 - Filter
 - Cool or Heat

Hemeon – Sutton Method



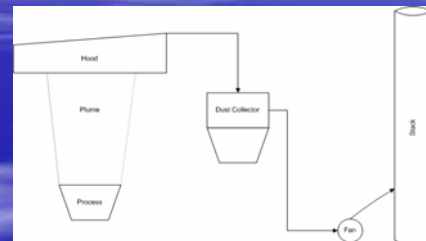
What do you do when there's no fire?

- Heat adds buoyancy – easier to control flow of dust & smoke
- Fans need power to work – but that's how you need to solve this situation
 - Air Blast transmits more force than suction
 - Suction induces negative draft – controls migration better
 - Intakes and hoods improve suction
 - Streamlining

Add a Fan

- Forced Draft – Blasts into fire
- Induced Draft – sucks out exhaust
- Remember the Smoke Blower!

Basic Collection Process



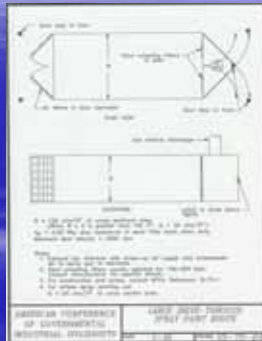
Power Sanding

- Relatively Recent
 - Porter-Cable: 1906
 - Black & Decker – similar
 - Milwaukee Electric Tools: 1924
- Mechanical advantage = increased dust evolution



Porter-Cable's first powered sander

Auto Repair Painting



Some of the More Challenging Situations



Real Buildings



Real Problems





