NACT 231

Coatings: Auto, Metal Parts and Products

National Air Compliance Training Program

Course Overview

- Ozone and Human Health -- HAPS
- General Overview of Coating Ops
- Coating Composition & Emissions
- Pollution Prevention and Control
- Control Devices
- Rules & Regulations
- Inspections
- Calculations

Why Are We Here?

Ozone Causes:

Alveolar Injury Leading to Pulmonary Inflammation and Permanent Lung Damage

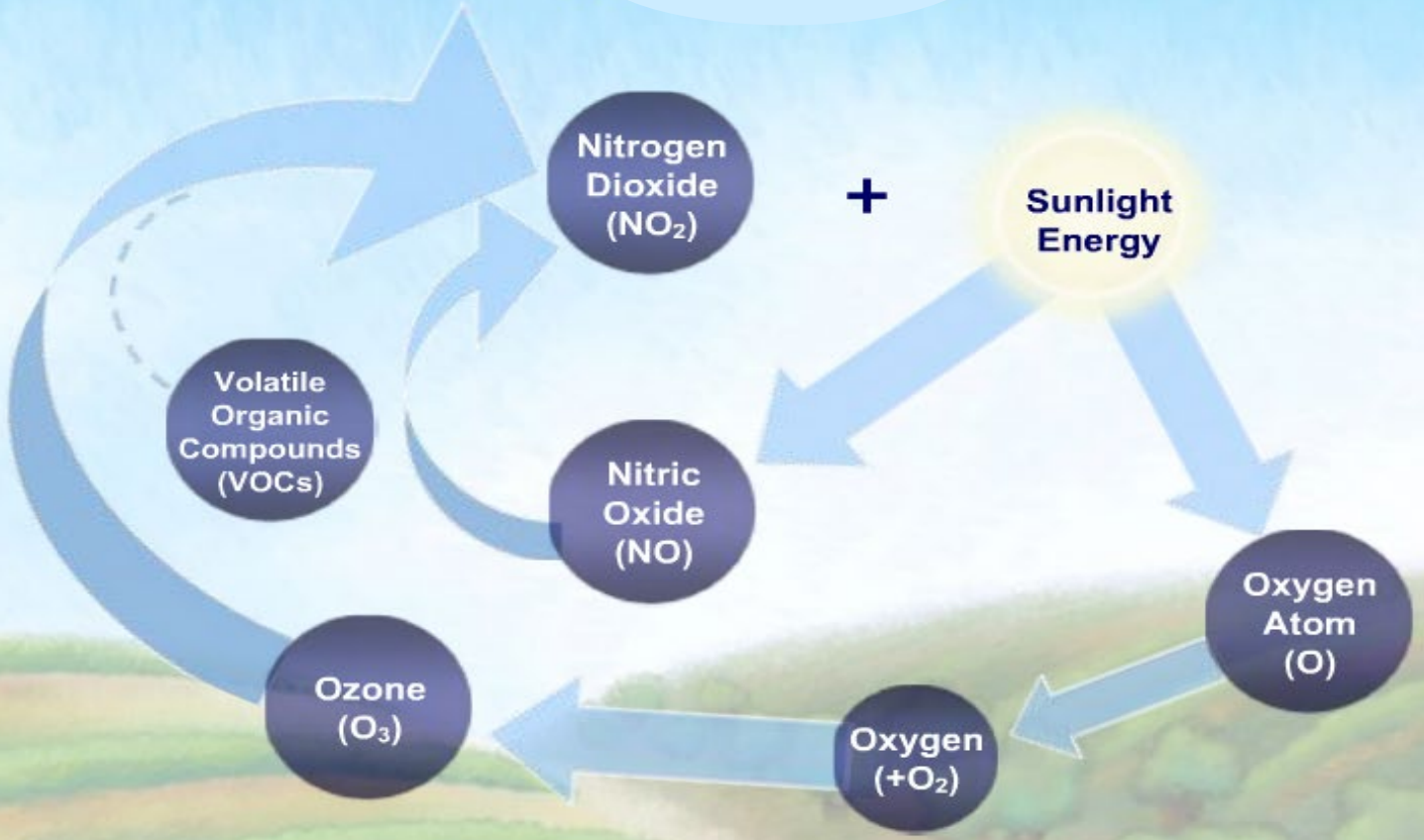
Respiratory Discomfort to Sensitive Populations

$330 Million in Crop Damage Each Year

Damage & Failure of Paints and Rubber Parts

Air Resources Board

Ozone Photochemistry



Coating Market Segments

- **OEM Product Coatings**
  - Automotive
  - Marine
  - Aircraft
  - Metal Containers
  - Appliances
  - Machinery and Equipment
  - Wood Furniture
  - Plastics
  - Coil
  - Overprint
- **Architectural Paints**
  - Interior
  - Exterior
- **Special Purpose**
  - Industrial Maintenance
  - Traffic Paint
  - Auto Refinish
- **Miscellaneous**
  - Roof, Tank, Deck
  - Concrete

Comparison of Automotive vs. Metal Parts

- More Steps/Coats
- Basically One Type of Application
- Booth or Outdoors
- Looks Are Everything

- Less Steps
- Many Application Types
- Booth
- Corrosion Resistance

What Are Metal Parts?

- Motor Vehicle Parts and Accessories
- Recreational Vehicles
- Heavy Duty Trucks
- Railroad Cars
- Bicycles and Sporting Goods
- Extruded Aluminum
- Structural Components
- Medical Equipment
- Lawn and Garden Equipment
- Electronic Equipment
- Magnet Wire
- Steel Drums
- Industrial Machinery
- Metal Pipes

What is a Coating?

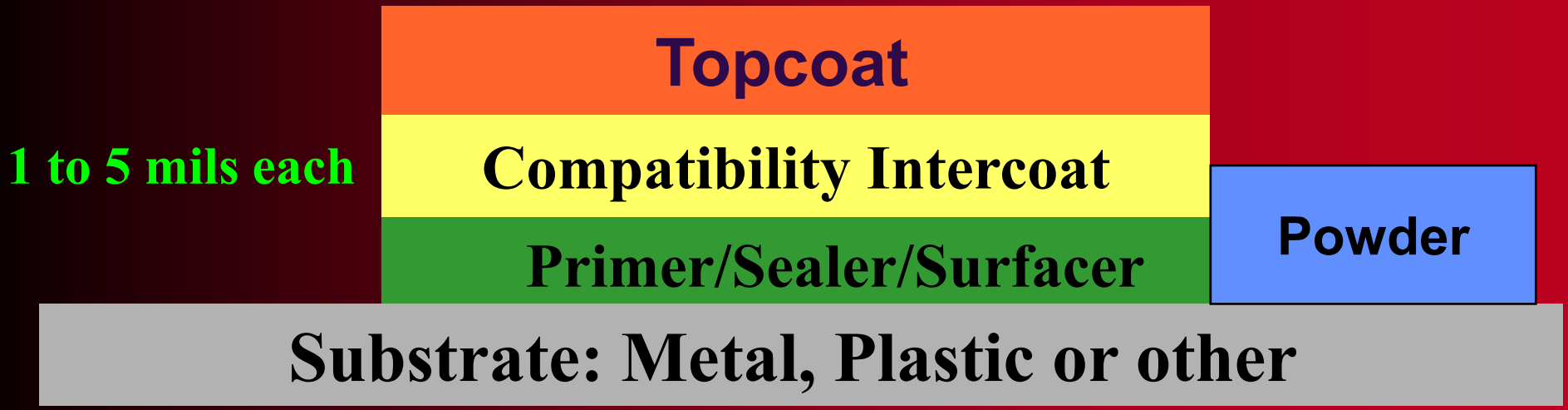
A thin film of organic material adhering to a mechanical device to protect it from corrosion or degradation by its environment. Consequently the color and texture of the surface are also altered.

What Kinds of Coating?

- Topcoat
- Undercoat
- Primer
- Sealer
- Surfacer


Phosphate Cleaner, Electro Deposition for Corrosion
Sealer
Primer
White, Black, Silver and Red
Base Coat
Top Coat and Clear Coat
New Car Coating Process

A Coating System



REFINISHING

Refinishing is the coating of vehicles, their exterior parts or components, or mobile equipment, including partial body collision repairs for the purpose of protection or beautification and which is subsequent to the coating applied at the manufacturers' assembly line.

--- EPA

Refinish Coating Manufacturers

- BASF InMont
- DuPont
- PPG/Ditzler
- Sherwin Williams
- Glasurit
- Sikkens

More than 65,000 Formulations for 13,000 Colors!!

Special Features of Auto Refinishing

Metal
White Primer
Grey Intercoat
Topcoat

Bondo Plastic Putty (dent filler)

Plastic & Fiberglass Body Parts

Color Matching

What's in a Coating?

Four components of any coating:

Binder aka Resin
Pigment
Solvents
Additives

BINDER

- Natural or Synthetic Resin
- Will Harden on Cue (Evaporation)
- Most Often a Plastic

Common Binders

- Nitrocellulose
- Acrylics
- Alkyds
- Polyurethanes
- Epoxies

PIGMENTS

- Small Hard Particles added for:
  - Color
  - Strength
  - UV Protection

SOLVENTS, DILUENTS AND THINNERS

Liquids Added To:

- **“Dissolve” Binder**
- **Adjust Viscosity**
- **Promote Adherence**
- **Promote Flow**
- **Drying & Curing**

Reducer


DUPONT
8022 S
MID-TEMP
REDUCER
DANGER!
128 FL. OZS. (ONE GALLON) 3.78 LITERS


DUPONT
V-3661S
ACRYLIC LACQUER THINNER
SPOT/PANEL REPAIR — 65°-75°F
LACQUER UNDERCOATS — WARM WEATHER
DANGER!
128 FL. OZ.
(ONE GALLON)
3.78 LITERS
DUPONT
3661S
Thinner


PPG
DITZ-O
Wax and Grease Remover
DX 440
ONE GALLON
3.785 LITERS
DITZ-O
Wax and
Grease Remover
DX 440
ONE GALLON
3.785 LITERS
DITZ-O
WARNING!
KEEP OUT
PPG
ACRYLIC LACQUER
PAINT REMOVER
DX 525
DANGER! POISON. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. MAY CAUSE MODERATE SKIN IRRITATION, SEVERE EYE IRRITATION AND MAY BE ABSORBED THROUGH THE SKIN. VAPOR AND SPRAY MIST HARMFUL IF INHALED. VAPOR IRRITATES EYES, NOSE AND THROAT. COMBUSTIBLE.
Read back panel for cautions and emergency instructions.
ONE GALLON
ACRYLIC LACQUER
PAINT REMOVER
DX 525
ONE GALLON


PPG
FAST EVAPORATING CLEANER
DX 220
ONE GALLON
3.785 LITERS
PPG
LOW VOC CLEANER
DX 380
DANGER! HARMFUL OR FATAL IF SWALLOWED.
IRRITANT. MAY BE ABSORBED THROUGH THE SKIN.
VAPOR AND SPRAY MIST MAY BE HARMFUL AND
IRRITATING IF INHALED. NON-FLAMMABLE.
Read back panel for cautions and emergency instructions.
ONE GALLON
3.785 LITERS

ADDITIVES

Material Introduced For:

- **Specific Effect on either Wet or Dry Film**
- **Less than 5% of total coating mass**
- **May or May Not Evaporate with solvent**

Poll Questions 1 & 2

VOC Control Strategies for Coatings

Use Reduction

- Use of Exempt Solvents
- Use of Water-Borne Products
- Increased Solids Contents
- Increased Transfer Efficiency

Retrofit Control Devices

- Capture and Reuse
- Capture and Destroy

Rule Provisions: Automotive Refinishing and Metal Parts

- Transfer Efficiency (T.E.) Provision
- Spray Booth Requirement (PM)
- VOC Coating Content Limits
- Open Container Limits
- Clean Up

Coating Type Formulations

Coating	% Organic Solvent	% Water	%Solids*
Solvent-Borne	~75	0	~ 25
High-Solids	< 40	0	60 - 80
Waterborne	0 - 20	< 80	50 - 100
Powder Coats	0 - 5	0	> 95

* Solids Include: Binders, Pigments & Additives

Exempt Solvents*

- Vary by Agency Definition
- Have a Variety of Human Health Effects Including Anesthesia and Intoxication
- Stratospheric Ozone Depletion
- Sometimes Incompatible with Aluminum or Water

*Negligibly Photochemically Reactivity

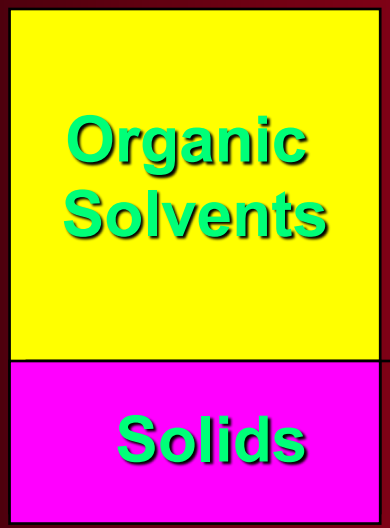
Waterborne Coatings

- Provide:
  - Solvent Penetration Protection
  - Low VOC
    - Reduced Fire Insurance
    - Easy Clean-up
- Require:
  - Careful Surface Prep
  - Temp. & Humidity Control While Curing or Longer Drying Times
  - Stainless Steel Equipment

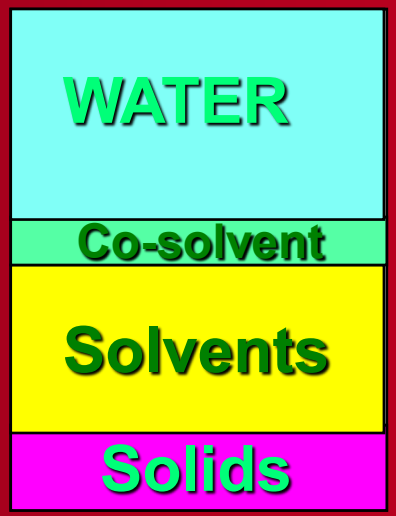
Difficulties for Waterborne Metallic Topcoats

- Hydrogen Evolution
- Flake Orientation (Critical Dry Times)

Water as a Diluent



x grams of solids covers area y



x grams of solids covers area y

Co-Solvent

(aka coupling agent)

Solvent that Causes Two Immiscible Liquids to Mix

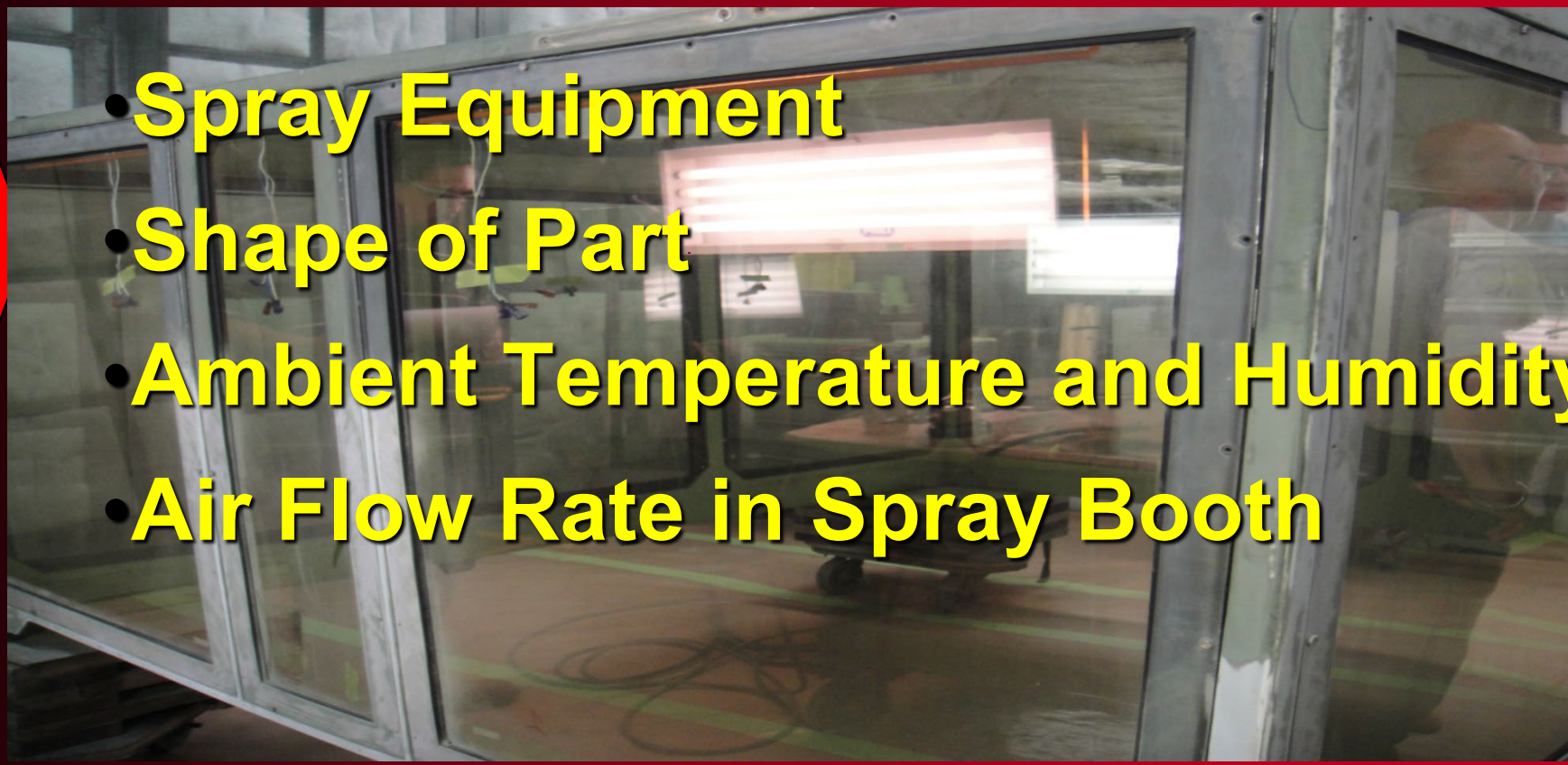
May Comprise up to 30% of the Liquid in a Waterborne Coating

Powder Coatings

Transfer Efficiency (T.E.)

Percentage ratio of the weight of solids deposited on the substrate to the weight of solids actually used

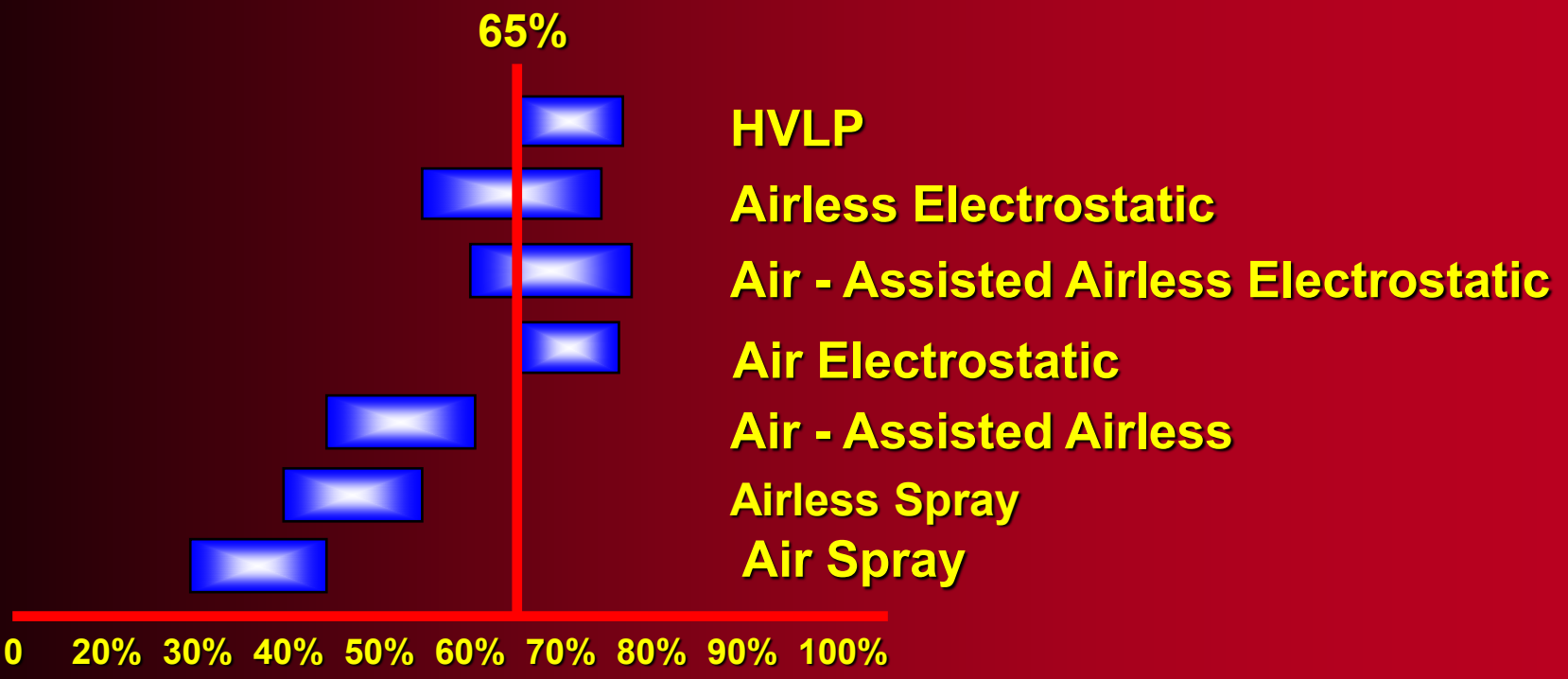
Transfer Efficiency Variables



- Spray Equipment
- Shape of Part
- Ambient Temperature and Humidity
- Air Flow Rate in Spray Booth

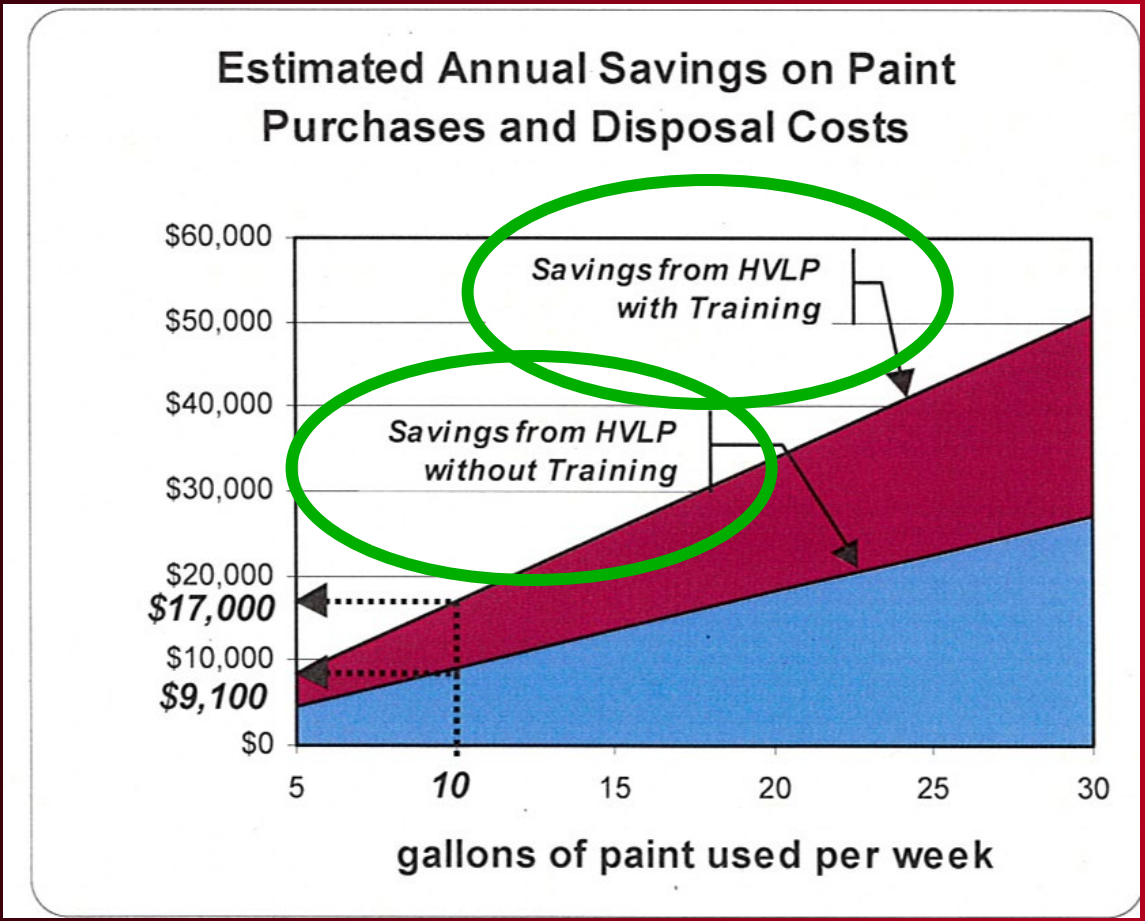
Transfer Efficiency Variables

- Coating Chemistry
- Painter Training and Experience
- Paint Pressure and Air Pressure at Nozzle



Percent Transfer Efficiency

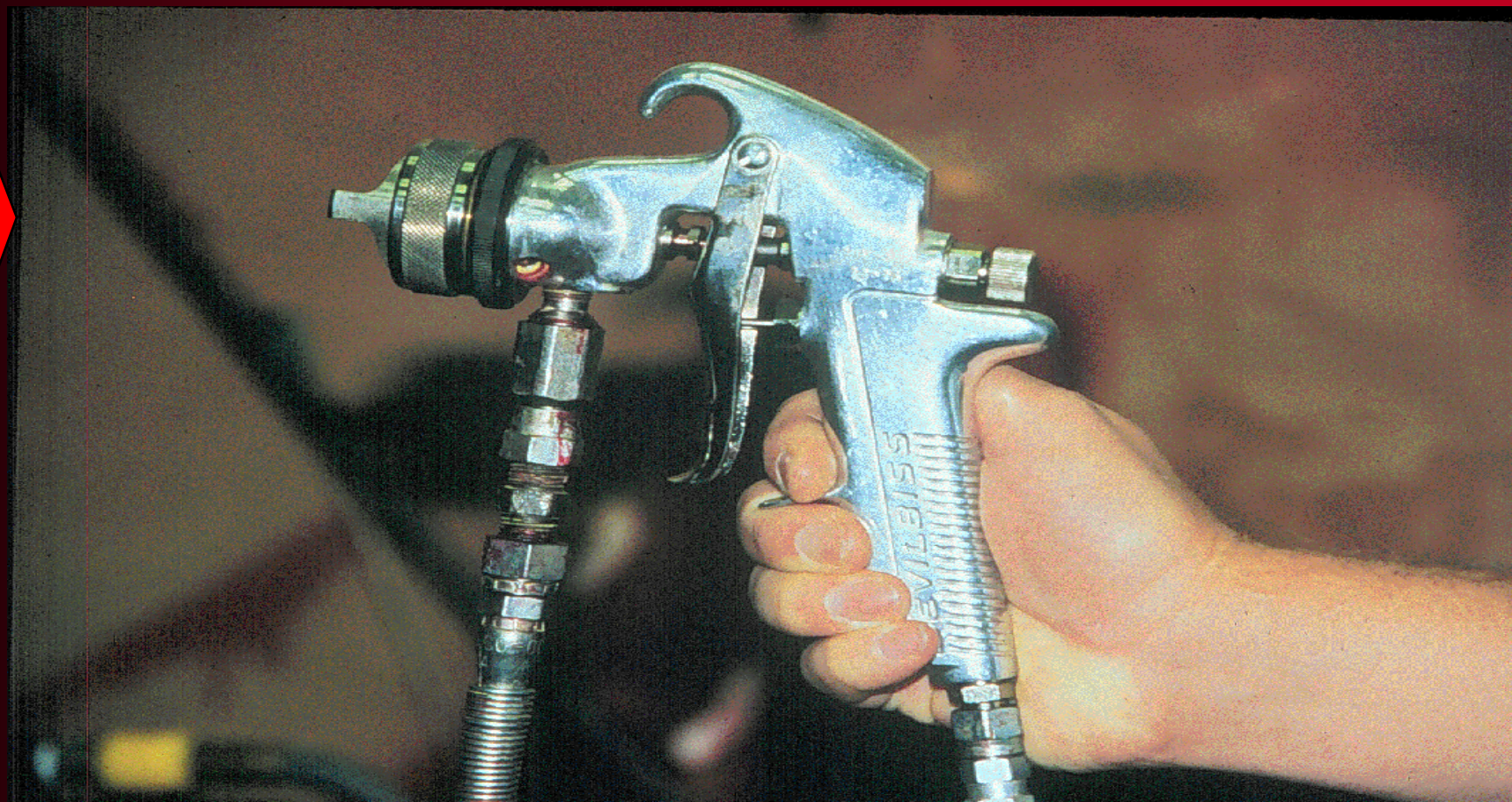
HVLP Transfer Efficiency Saves $$



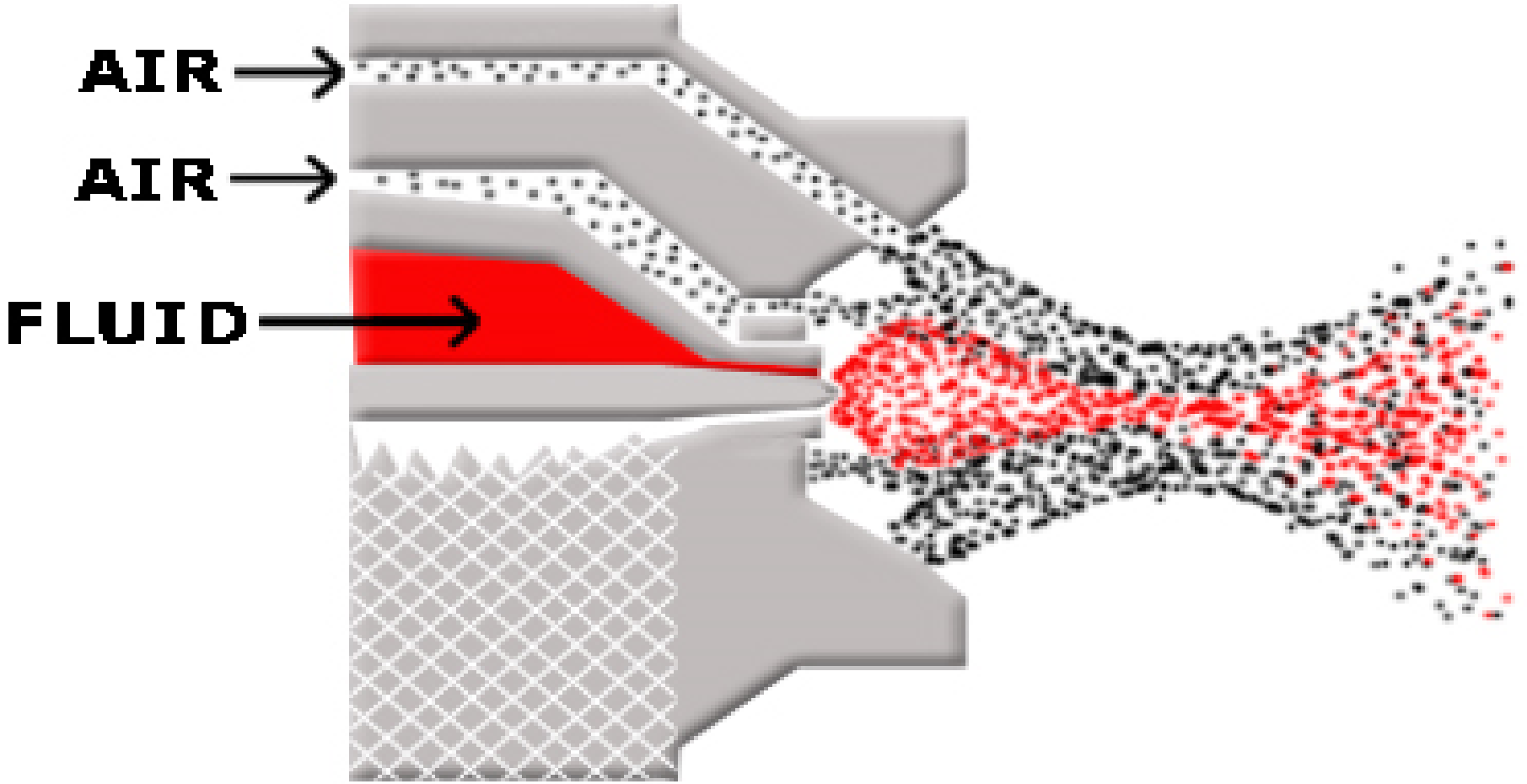
Gun Control

Air Spray Video

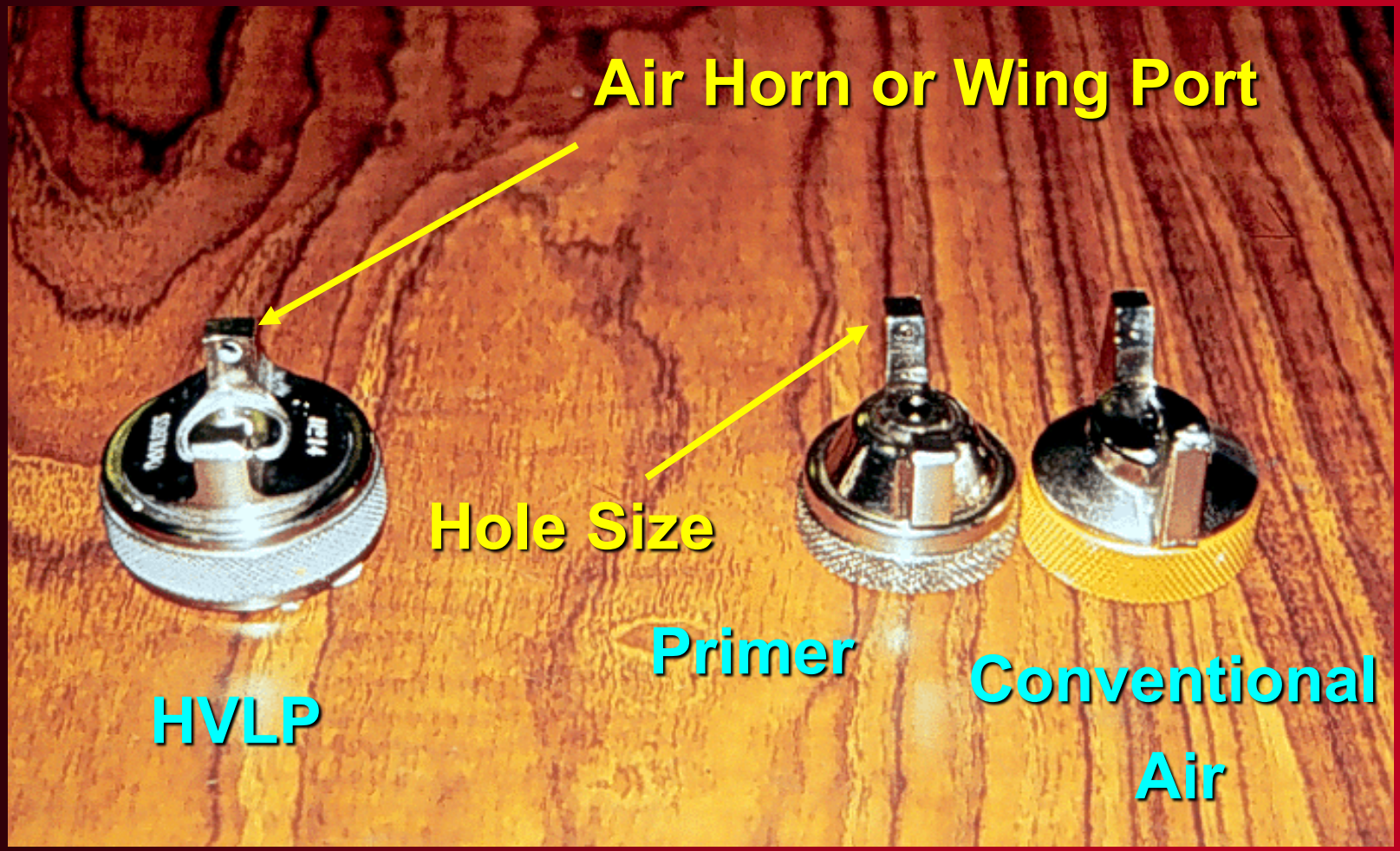
HVLP? DeVilbiss Gun



AIR ATOMIZATION



HVLP Caps


Air Horn or Wing Port
Hole Size
HVLP
Primer
Conventional
Air

Spray Cap Pressure Gauge

Digital
Air
Pressure
Readout

Gun Air Pressure Gauge.
Can this Replace the Spray Cap Pressure Gauge?

HVLP Gun Manufacturers

SATA High end products with precision engineering and digitally controlled mechanisms.

DeVilbiss Age old industry standard spray gun. A wide range of models.

Sharpe American made, budget price.

Binks Another industry standard gun. Binks guns share a market niche with DeVilbiss.

Accuspray Only gun with a plastic body

Astro Pneumatic guns are modeled after higher priced models above .

Spray Gun Feed Options

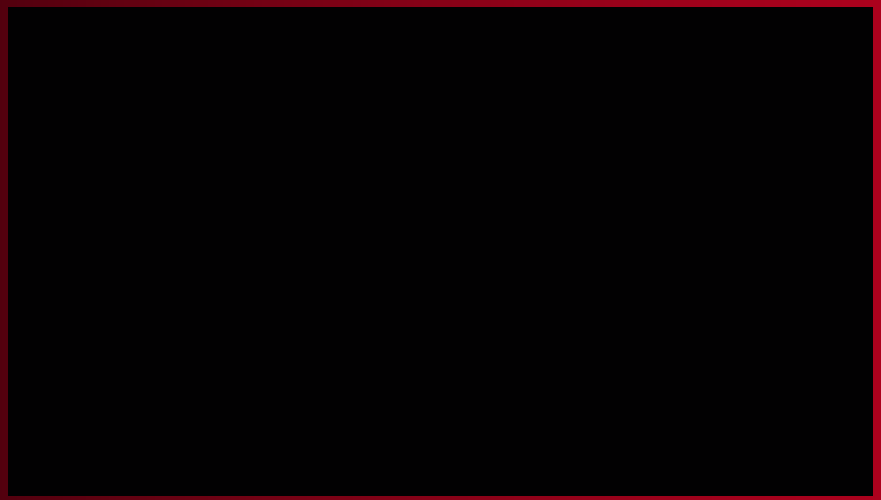
Gravity Feed

Suction/Siphon Cup

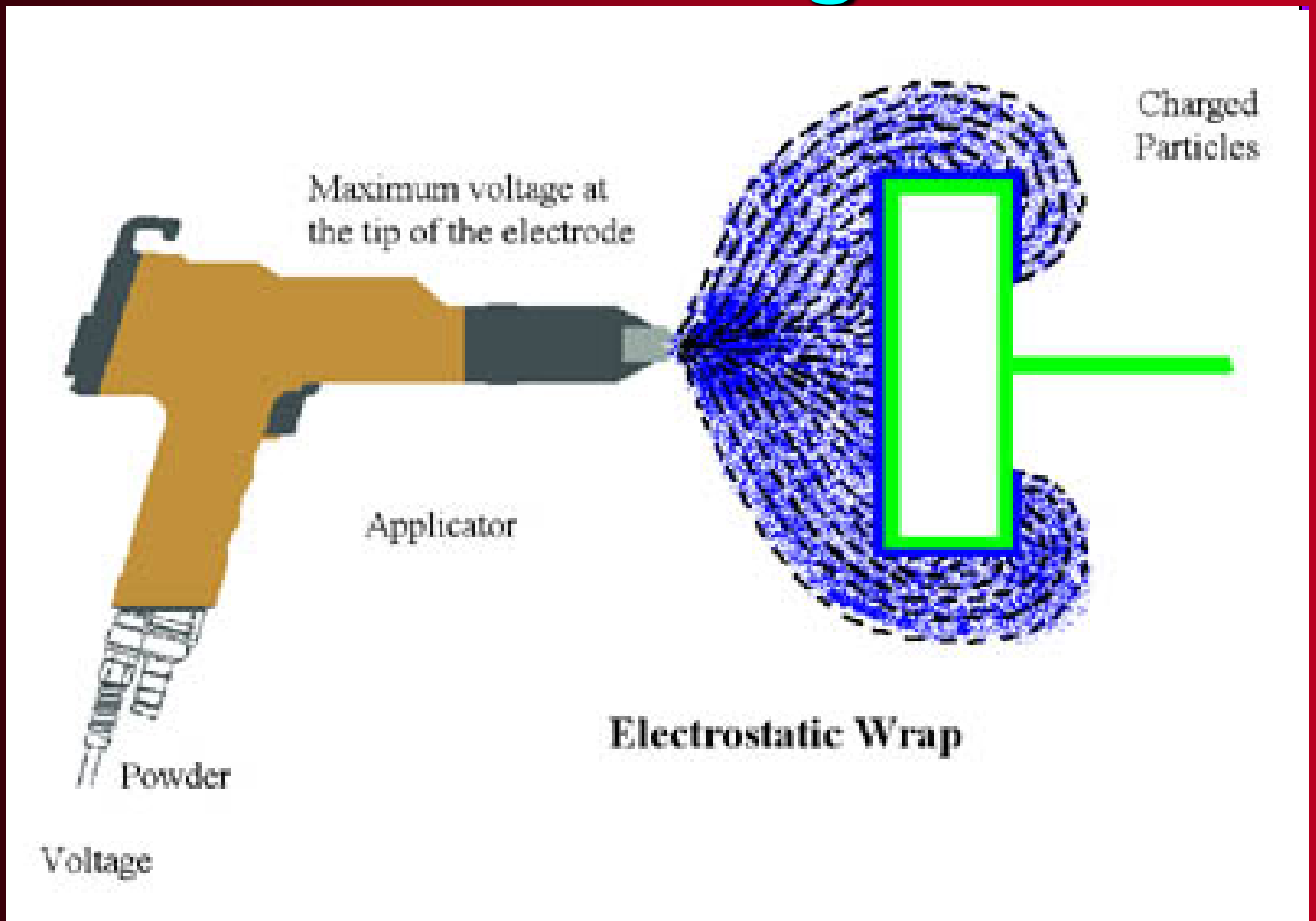
Pressure Feed

Electrostatic Spray Gun Note: Charging Electrode

Electrostatic Spray Video



Powder Coating Gun



Powder Coatings Video

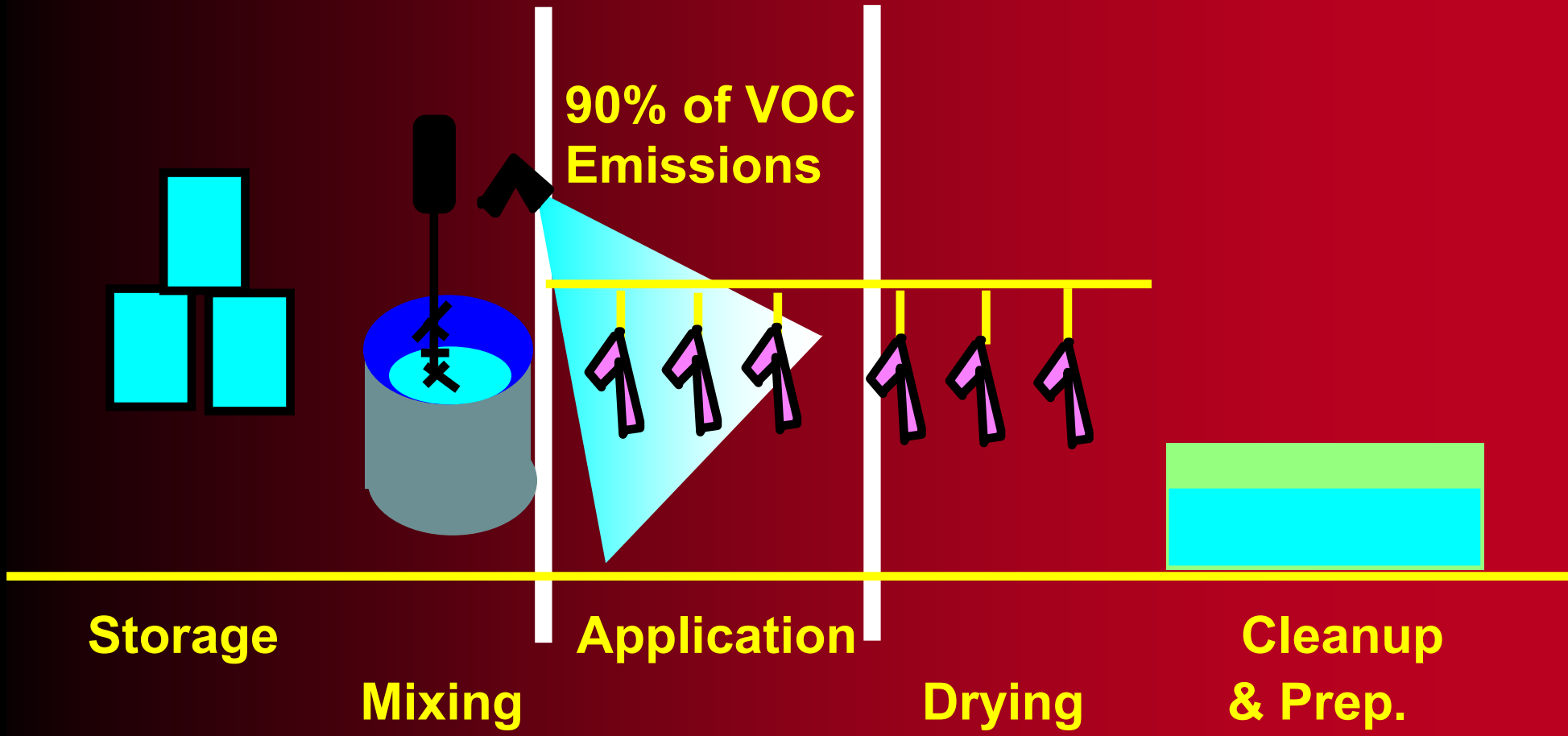
Powder Coated Products

Poll Questions 3 & 4

Coating Steps and Points of Emission

- Abrasive Sanding or Blasting
- Surface Clean and Prep
- Primer & Topcoat Application
- Flash Off -- Drying
- Curing
- Touch Up
- Equipment Clean Up

Points of VOC Emission

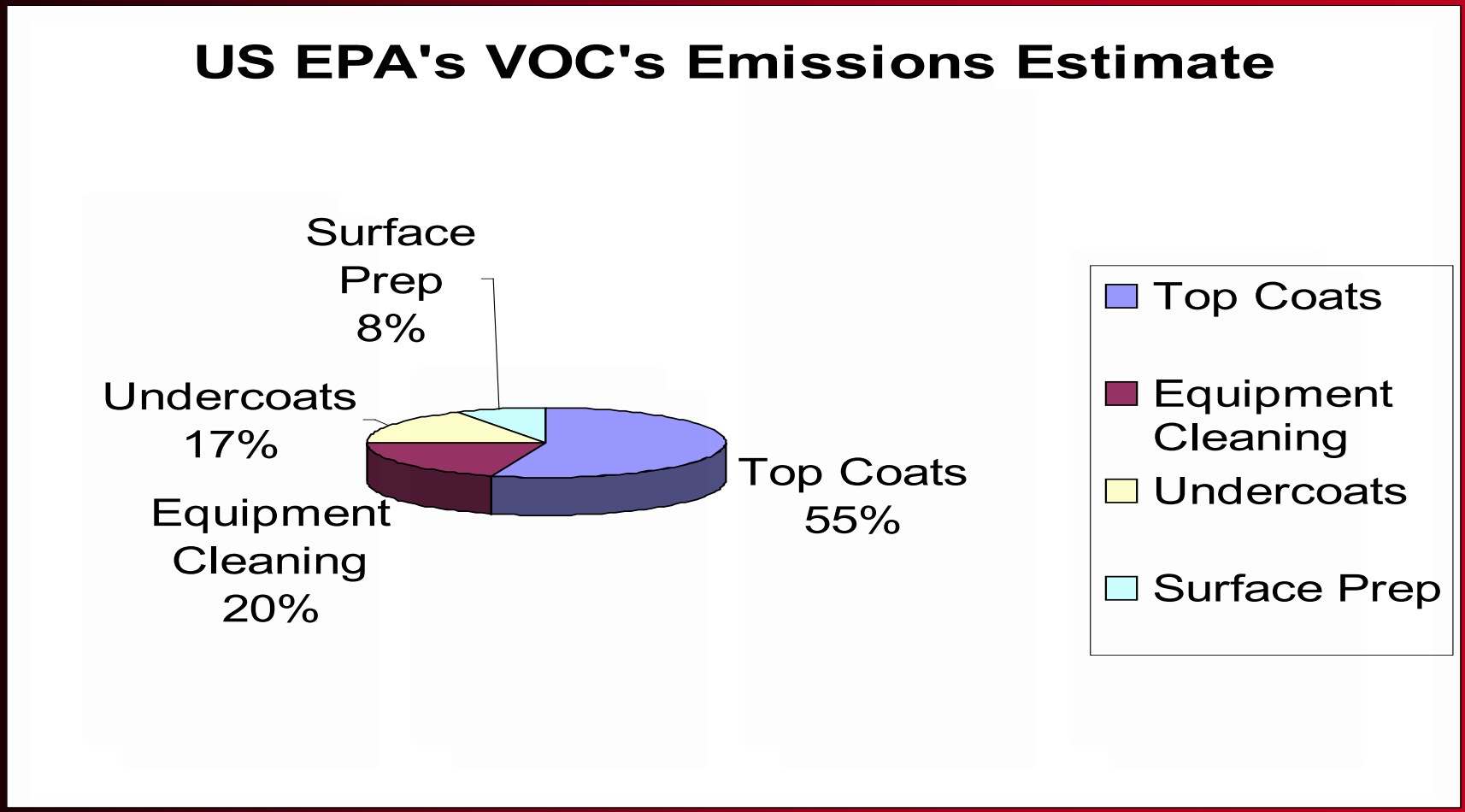


Surface Preparation

- Abrasive Sandblasting
- Body Filler (Auto)
- Cleaning/Degreasing
- Application Acid Etching

Surface Preparation

VOC Emissions Automotive



Curing

The Process in which Paint is Converted from Liquid to Solid

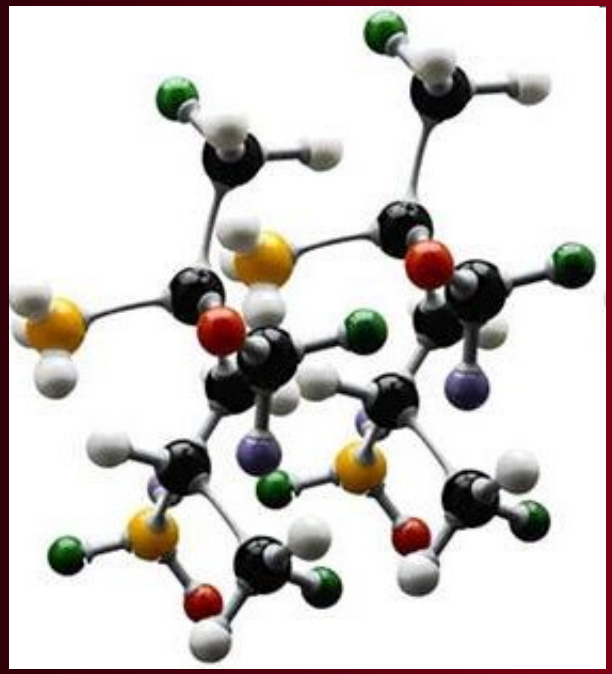
Curing and Coating Types

- Air Drying
- Lacquers
- Enamels
- Powder Coats
- High Solids
- Waterborne

More on Curing - Lacquer

- Cures by the Evaporation of the Solvent

More on Curing - Enamel



Cures by an Irreversible Chemical Reaction Involving Various Components or Atmospheric Water or Oxygen

Curing Methods

- Air dried
- Thermoset or Thermocure
  Baked Coating > 194°F
- Thermoplastic
- Radiation

Curing Times

- Air dried — hours
- Oven Baked — minutes
- Epoxy Systems — minutes
- Ultraviolet (UV) — seconds
- Electron Beam — < 1 second

Curing Types (cont.)
Thermoset/Thermocure

- Solid Resins
- Heated - melt and flow
- Cross-link to form Higher Molecular Weight Solid
- Remains Stable After Heating

Curing Types (cont.)
Thermoplastic

- A Polymer
- Liquid when Heated
- Freezes Glassy when Cooled
- No Cross-linking
- Re-melted, Re-molded, and Recycled

Oven Cured Temps

Automotive Ops Are Special

Forced Dry or Accelerated Drying with heat lamps

Is this a baked cure?

194° F
Regulatory Cutoff

Poll Questions 5 & 6

Control Alternative

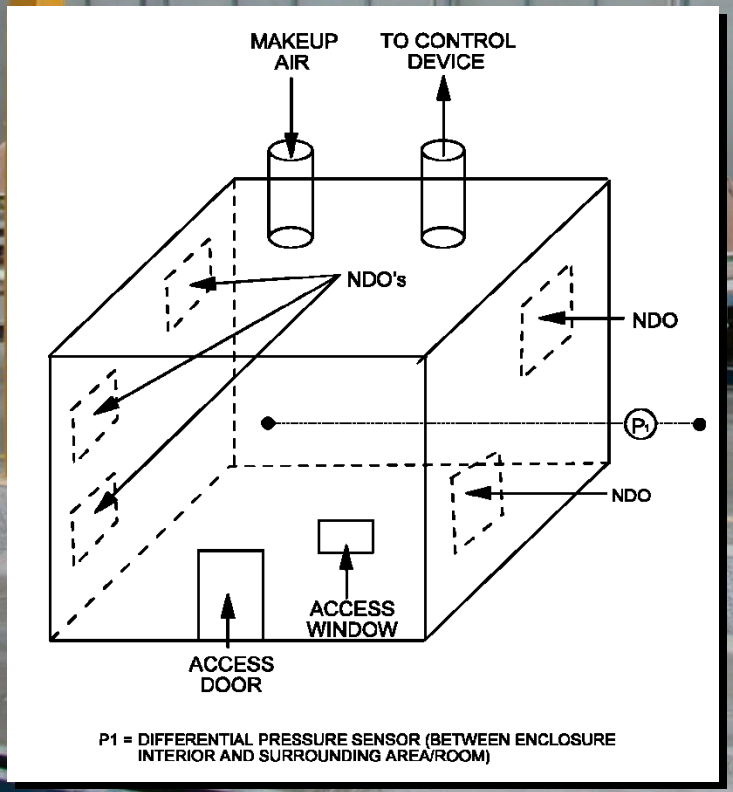
Rather than Meet VOC Limits a Source May:

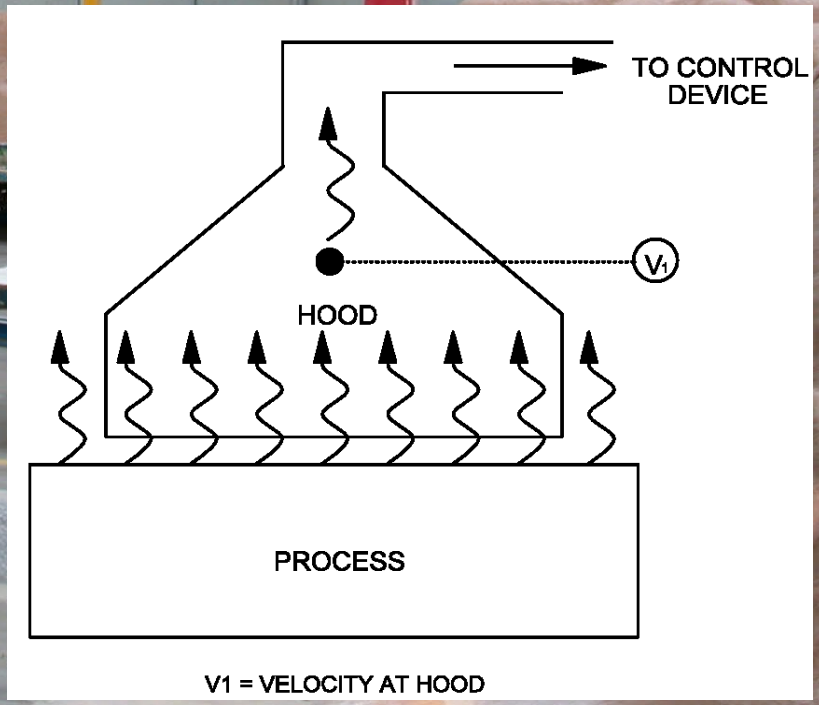
- Collect at Least a Required Percent by Weight of Emissions

And

- Transport to a Central Device that Reduces Emissions at Least a Required Percent (Total Control = 85%)

Capture System Schematic





Booth Design

Down Draft Spray Booth

Water Wash Spray Booth

VOC Control Techniques – Capture System

- Performance indicators
  - Enclosures (Spray Booths)
    - Face velocity
    - Differential pressure
    - Average face velocity and daily inspections

Baghouse for Powder Coater

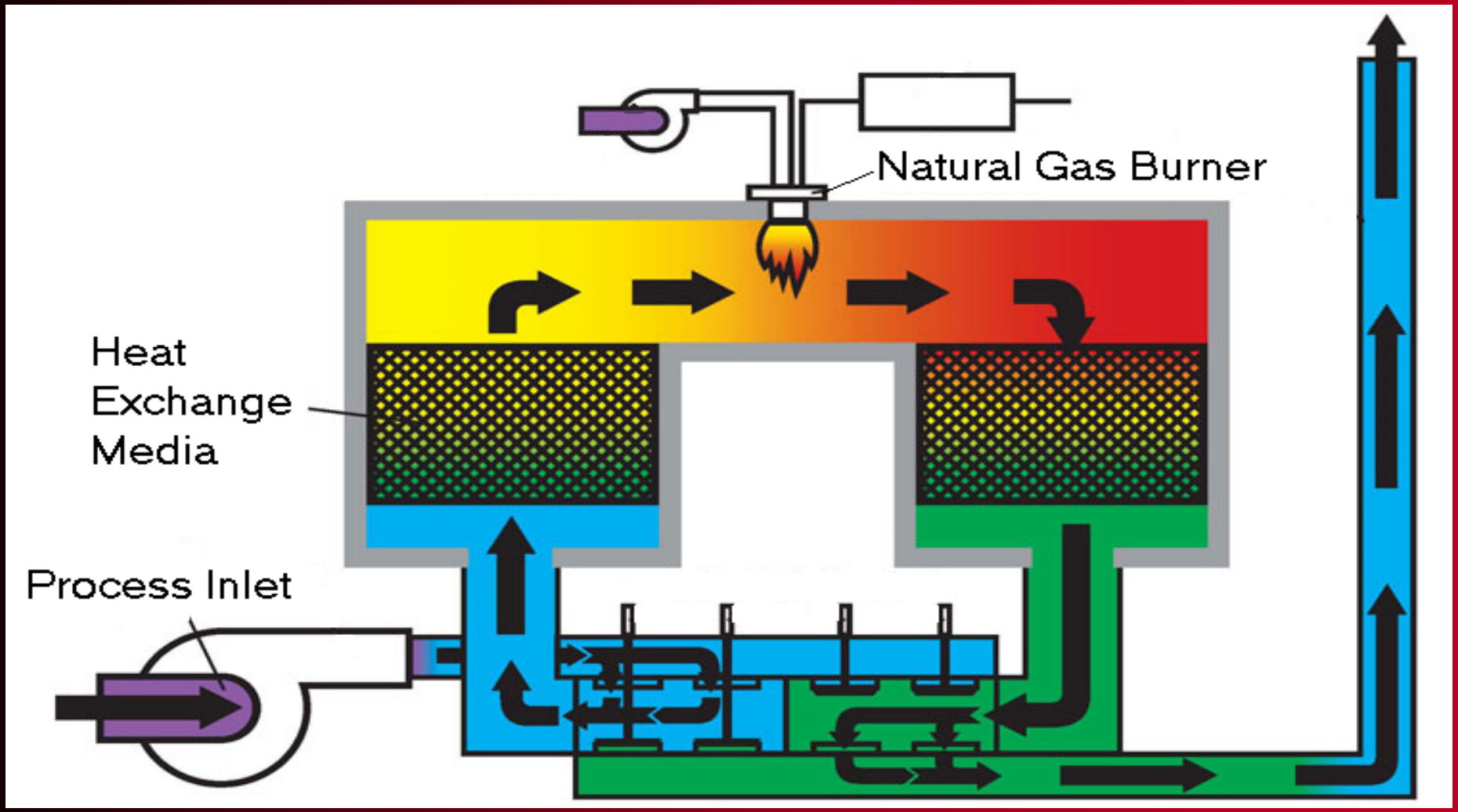

REMEMBER
Booth is for PM Only
NOT VOC's

VOC Control Equipment

- Incineration
  - Direct Flame – Thermal Oxidizer
  - Catalytic Oxidizer
- Carbon Adsorption
- Condensation
- Absorption

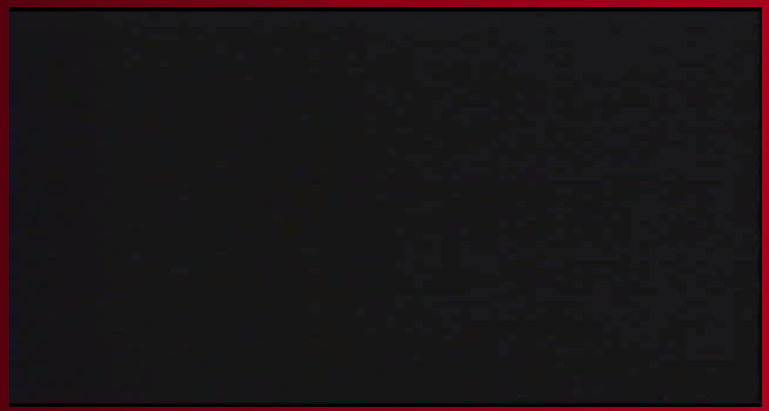
Catalytic Oxidizer

Regenerative TO - RTO

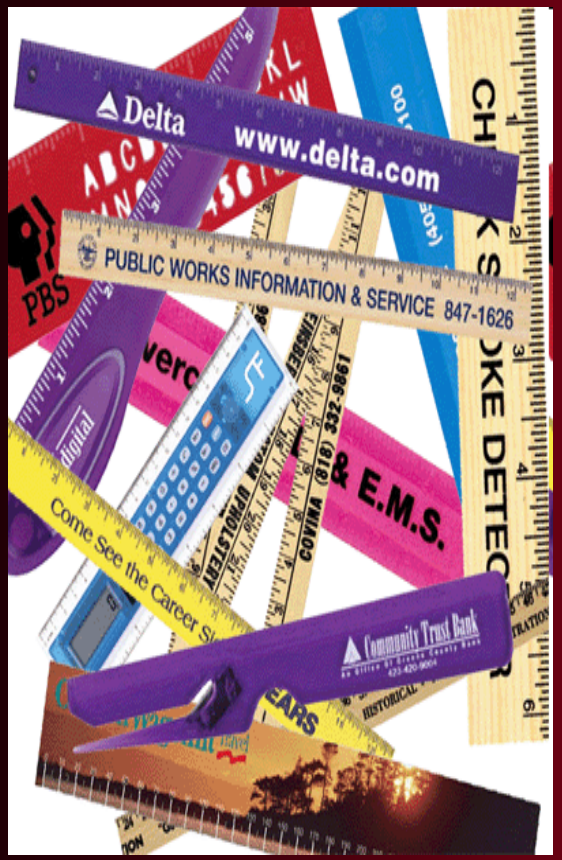


Poll Questions 7 & 8

MACT Case Study Video



Applicable Rules



- Nuisance
- Visible Emissions
- Prohibitory & NSR
- HAPS
- Permits
- Fugitive Dust (PM)


UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

Why NESHAP's

- Hazardous Air Pollutants (HAPs)
- Toxic Air Contaminants (TACs)
  - Chromium
  - Cadmium
  - Lead
  - Manganese

NESHAPS Misc. Metal Parts

- A Major Source If More than 10 tons per year of any ONE Hazardous Air Pollutant or 25 tpy or more of any COMBINED HAPs
- The Operator Will be Subject to Maximum Achievable Control Technology (MACT)
- 40 CFR Part 63 MMMM for Misc. Metal Parts

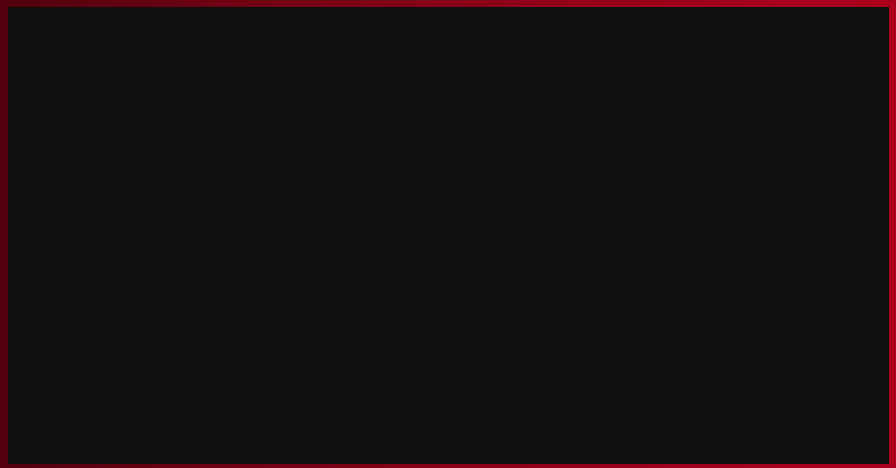
NESHAPS Misc. Metal Parts

Coating	lb. HAP / gal solids*
General	1.9
High Performance	27.5
Magnet Wire	0.44
Rubber-to-Metal	6.8
Fluoropolymer	12.4

* also written in terms of kg HAP per liter of coating solids

This is for new sources, existing usually have higher allowances

6 HHHHHH Rule Video



NESHAPS: Paint Stripping and Misc. Surface Coating Ops at Area Sources

- 40 CFR 63 Subpart HHHHHH
- Initial Notification by Jan. 10, 2010 for Existing Sources
- Jan. 9, 2008 for New Sources
- Exclusions (Military, labs, etc.)

HAPS AFFECTED

- Chromium
- Lead
- Manganese
- Nickel
- Methylene Chloride

HHHHHH Rule Provisions

Motor Vehicle and Misc. Surface Coatings

- Train/Certify ALL Painters
- Spray Booth Requirements
  - 98% Capture Efficiency
  - Enclosures - Auto Complete

More on Training

- Painters must be certified as completing training in proper spray application of surface coatings, setup and maintenance of spray equipment
  - Except students of accredited surface coating training program who are under the direct supervision of an instructor who is certified

More on Training

- Training program must include:
  - Spray gun equipment selection, set up, and operation
  - Best spray technique for different types of coatings to improve transfer efficiency and minimize overspray
  - Routine booth and filter maintenance, filter selection and installation
  - Compliance with requirements of the NESHAP

More on Training

- Owner or operator must certify training of each person was completed
- Certification must include:
  - List of personnel who are required to be trained, with name and job description
  - Hands-on and classroom instruction, covering elements of training program at a minimum
  - Description of methods used at completion of initial or refresher training to demonstrate successful completion

More on Booths

- **Spray Booths and Prep Stations**
  - Booths and prep stations for complete motor vehicles or mobile equipment must
    - **Have full roof and four walls or side curtains, and operate at negative pressure;**

    OR

    - **If sealed doors/openings + automatic pressure balancing system, booth operated at up to, but no more than, 0.05 inches w.c.g. positive pressure**

More on Booths

- **Spray Booths or Prep Stations**
  - **Booths or prep stations for miscellaneous coating or vehicle sub-assemblies**
    - **Have full roof, at least 3 complete walls or side curtains, and ventilated so air is drawn into the booth**
    - **Roof and walls may have openings for conveyors**

Recordkeeping

- **Surface Coating**
  - Painter training certification
  - Documentation of filter efficiency
  - Copies of all notifications and reports required
  - Records of any deviations from requirements in the rule, including date and time period it occurred, a description of deviation, and corrective actions taken
  - If spray gun does not meet definition of acceptable technologies and has cup capacity at least 3.0 oz., documentation from spray gun manufacturer that Administrator has determined equivalent transfer efficiency

Possible SIP Automotive Req'ts

- Prohibition of Non-Compliant Coatings
- Prohibition of Specification
- Reactive Organic Compound (ROC) Content Must be Listed on Either the Container or Product Spec. Sheet
- All ROC Stored in Sealed Containers
- Operator Must Maintain all Records Necessary to Determine Compliance
- Specialty Coatings May Not Exceed 840 gm/ltr or 5% of Monthly Usage

Possible SIP Automotive Requirements

Coatings Must be Applied Using High-Volume Low-Pressure (HVLP) Equipment

OR

Agency Prohibitory Rules May Require Best Available Control Technology

Possible SIP Automotive Req’ts

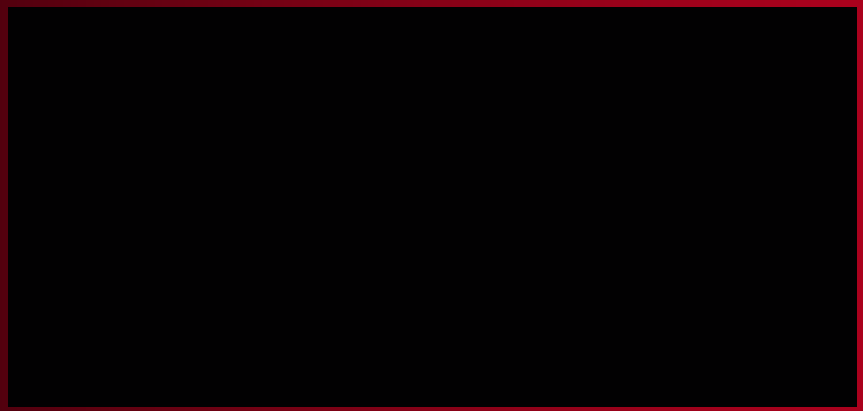
Poll Questions 9 & 10

Inspections

Pre-Inspection

Obtain Inspection Forms
Permit Review and Check
Safety Equipment Check
Regulation Review
File Review
Meeting at Facility with Representative

Inspection Video



Inspection

Look for
Open Containers

Open Containers?

Good Housekeeping?

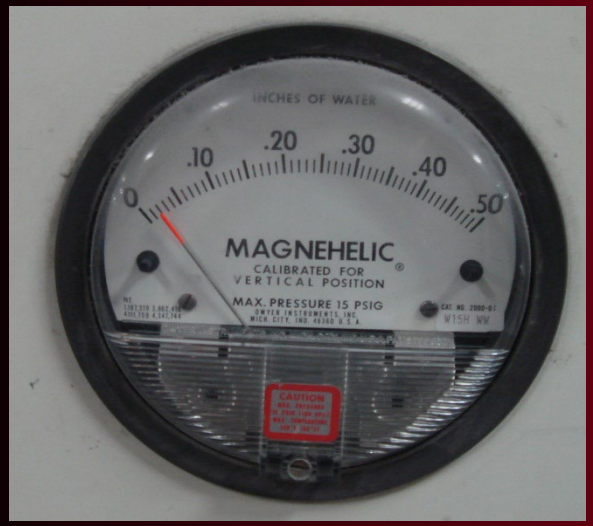
Speaking of Rags

Booth Inspection

Booth Inspection

Violation?

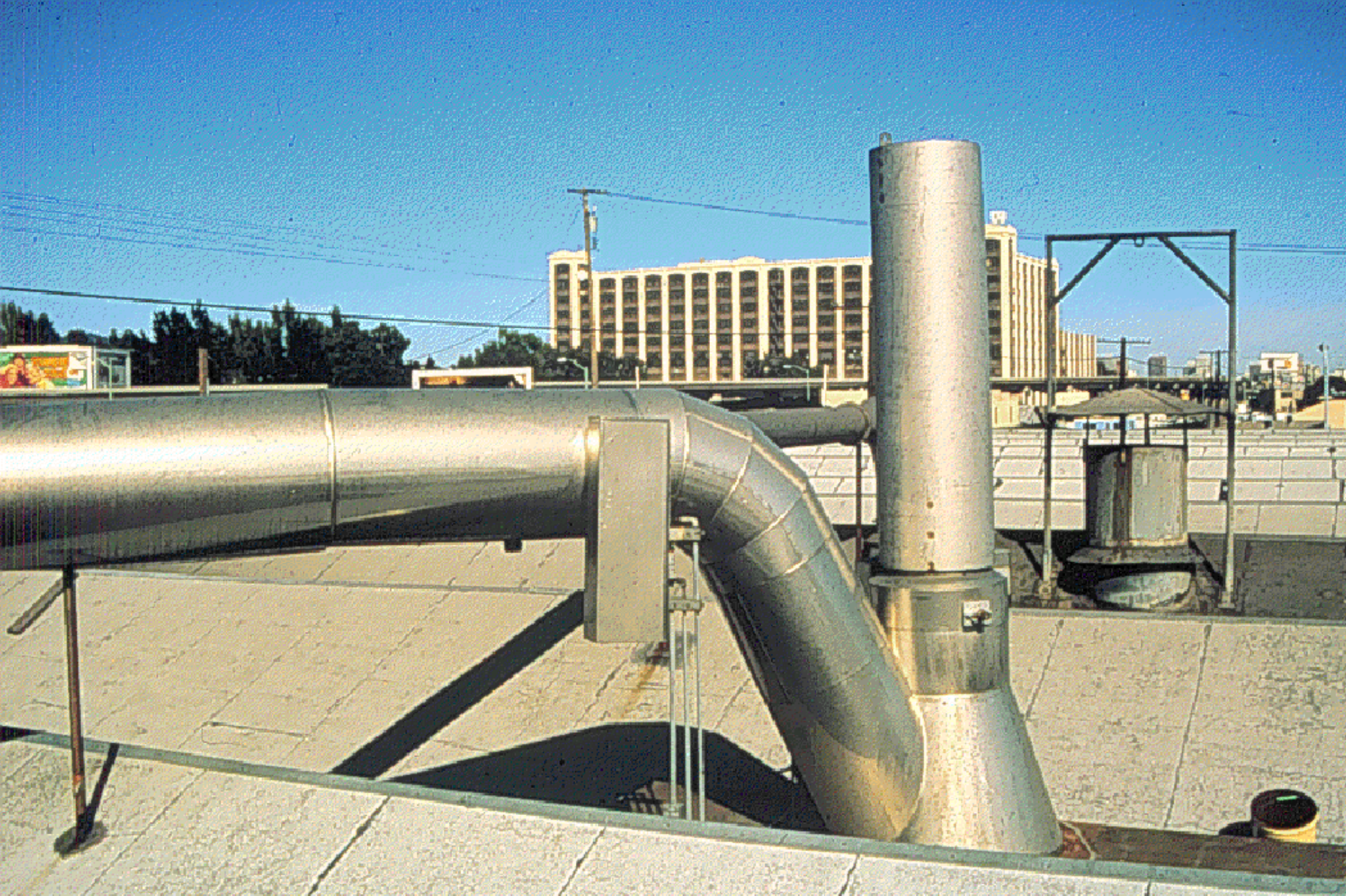
Inspection



Check Pressure Drop (∆p) Across Filters

Check Filters.
Dirty, Painted or Clogged?

Inside the Mixing Room



Inspection

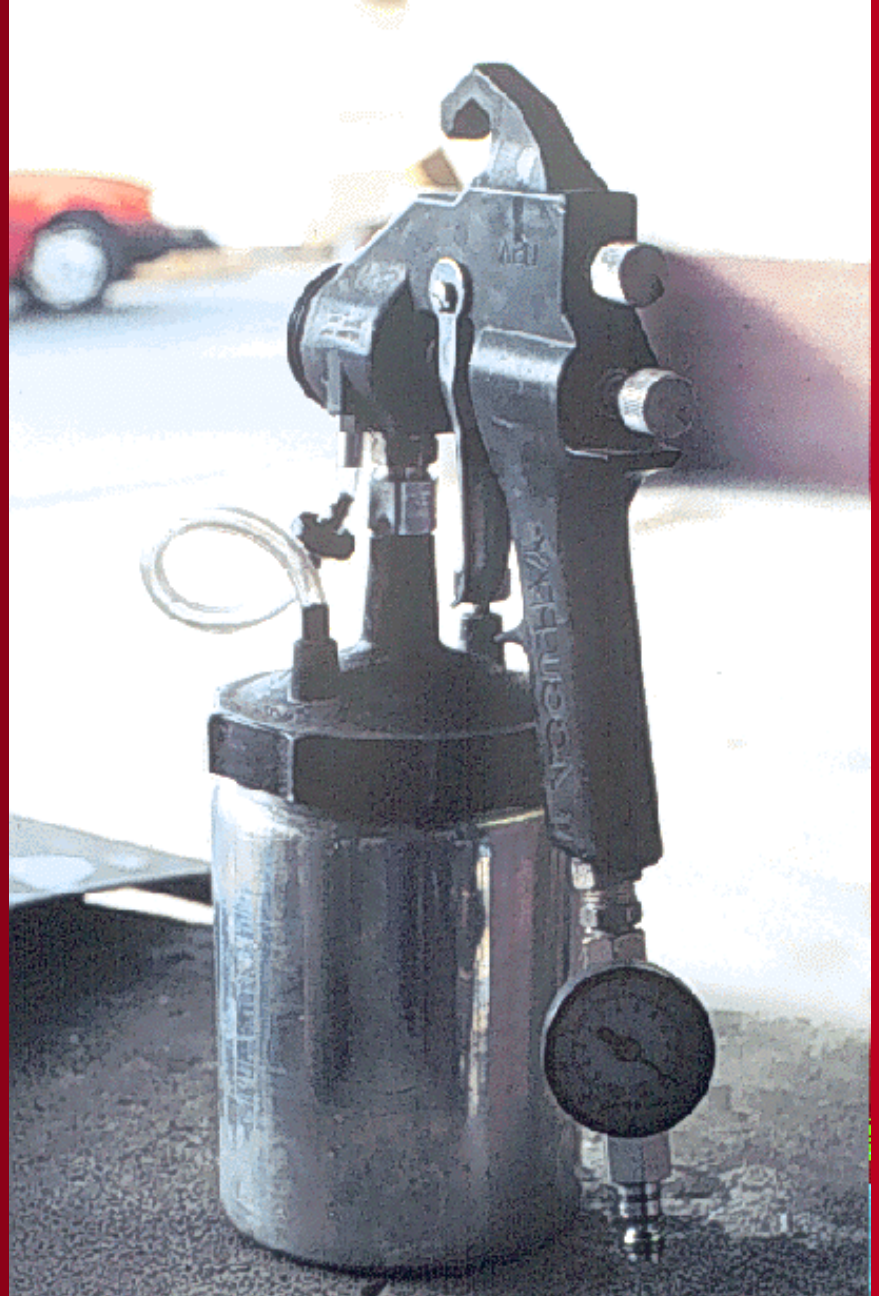
Automated VOC tracking system

Solvents

- Used for Cleaning
  - Tar
  - Prep for Plastic
  - Removing Adhesive

Inspection

- Do we need a spray cap pressure gauge?

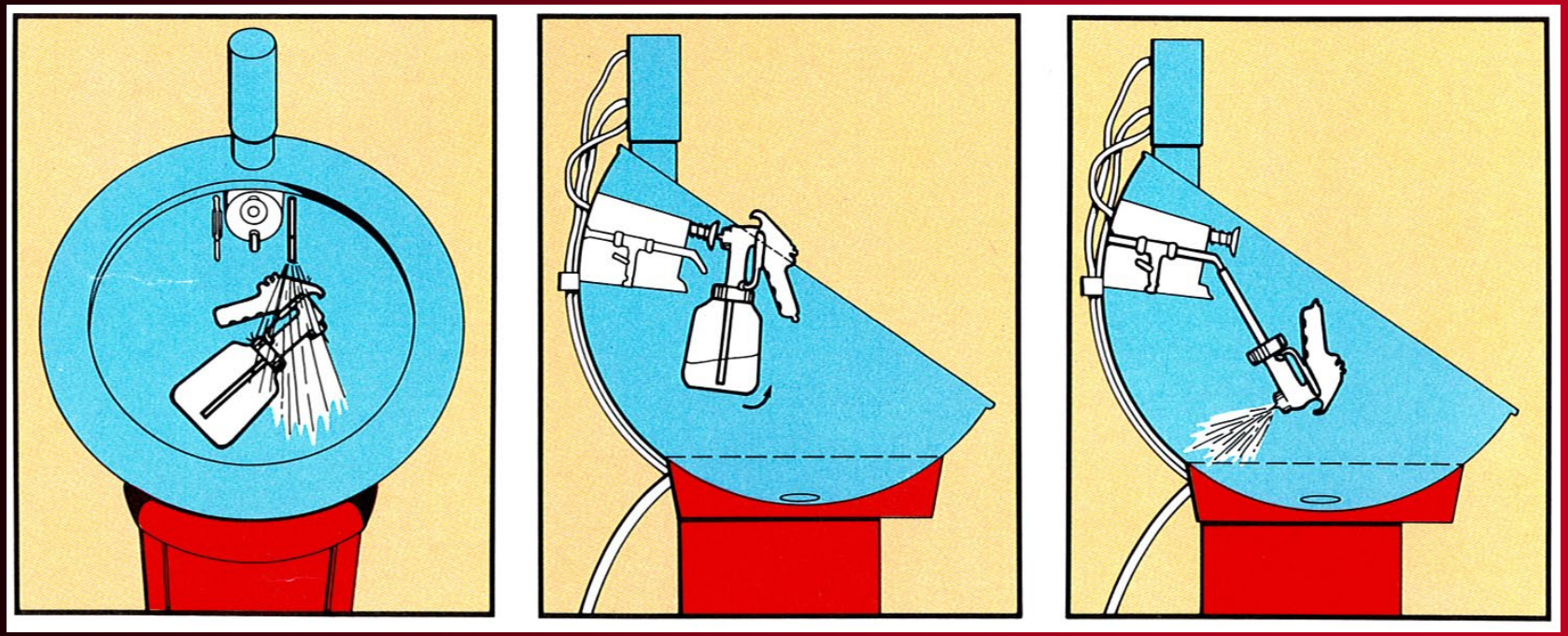



Acetone
Reclaim
System

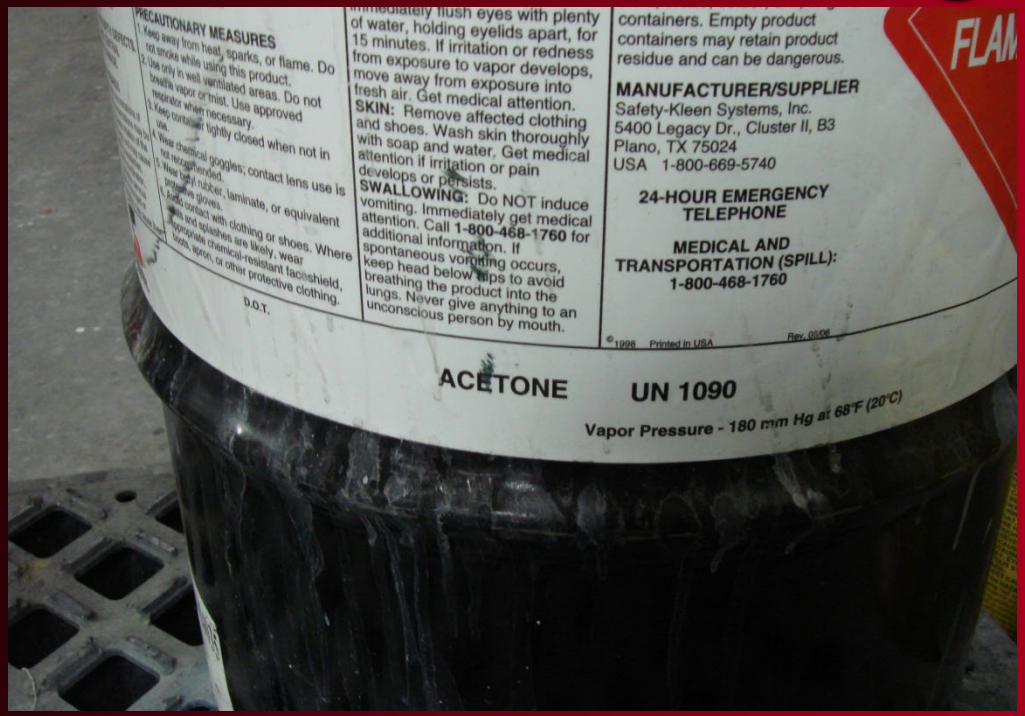
Inspection

SAFETY-KLEEN Spray Gun Cleaner.
Is this a covered or open container?

How The Gun Cleaner Works

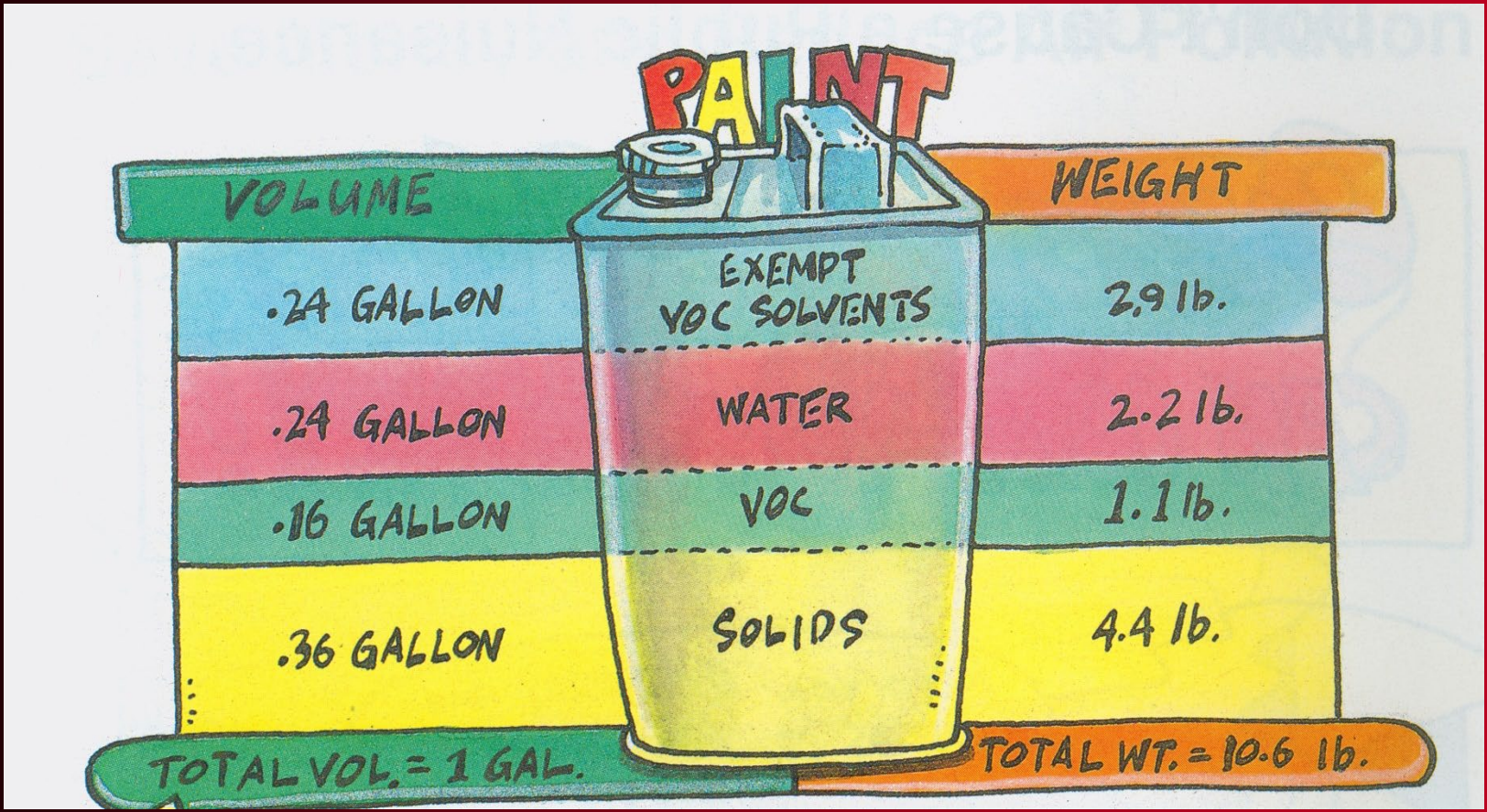


Alternative Cleaning Solutions

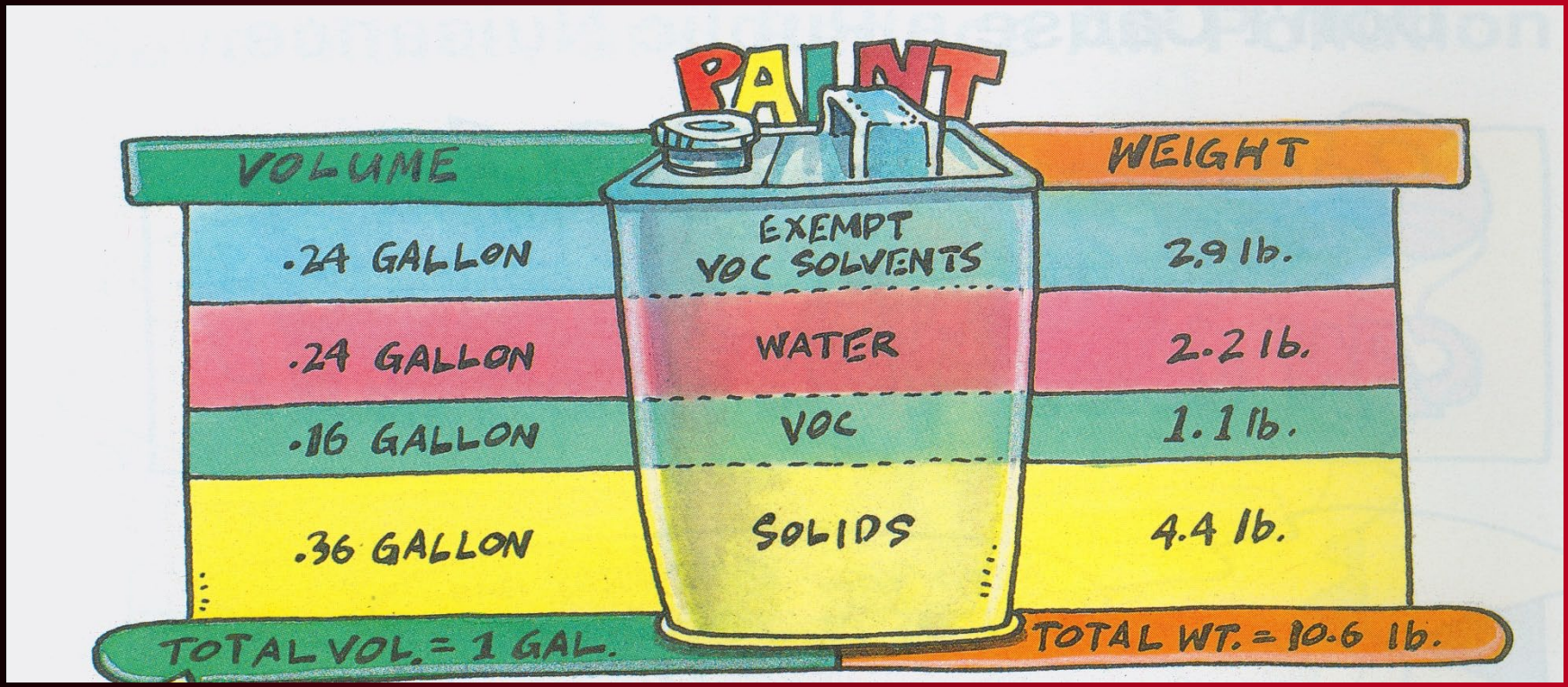



Recordkeeping Review
• Longest Part of the Inspection
• Do They Keep Records ?
• Check Permit Requirements
Farmers
Downtown VOC 2008
MATERIAL SAFETY DATA SHEETS

Time for Calculations

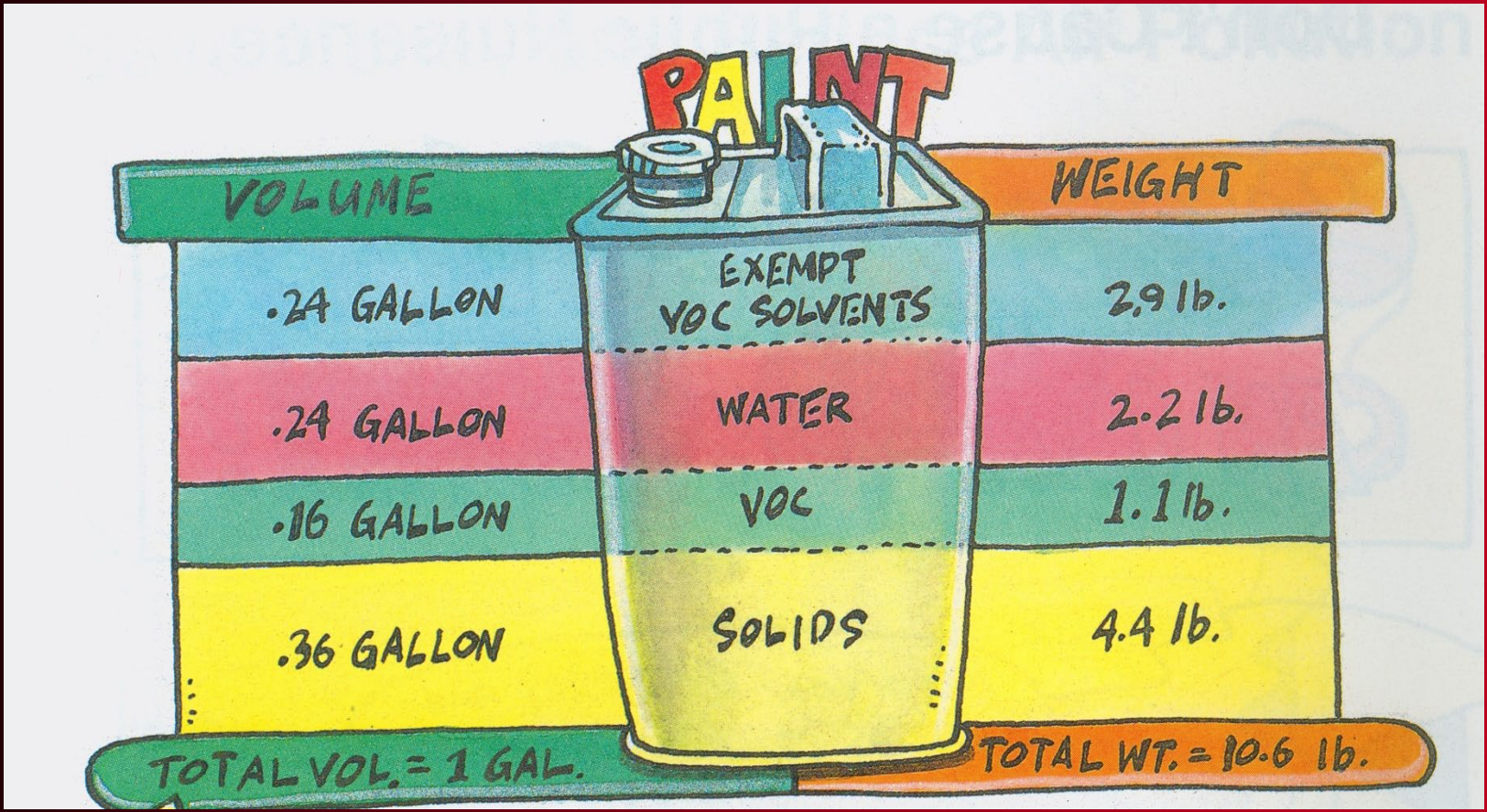


What is the VOC content of this coating?

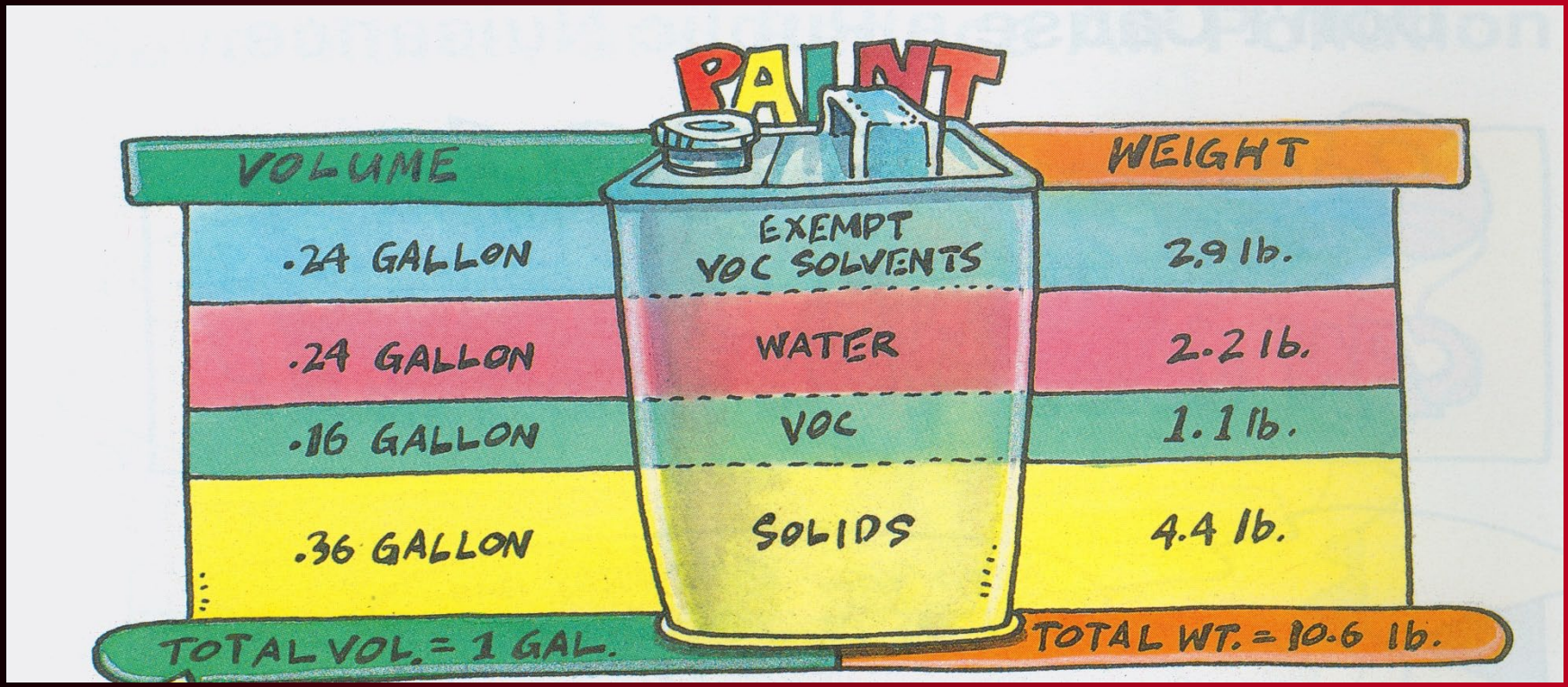


$$\frac{\text{1.1 lbs VOC}}{\text{(1 Gal - .24 gal - .24 gal)}} = \text{2.1 lbs/gal}$$

Time for Calculations



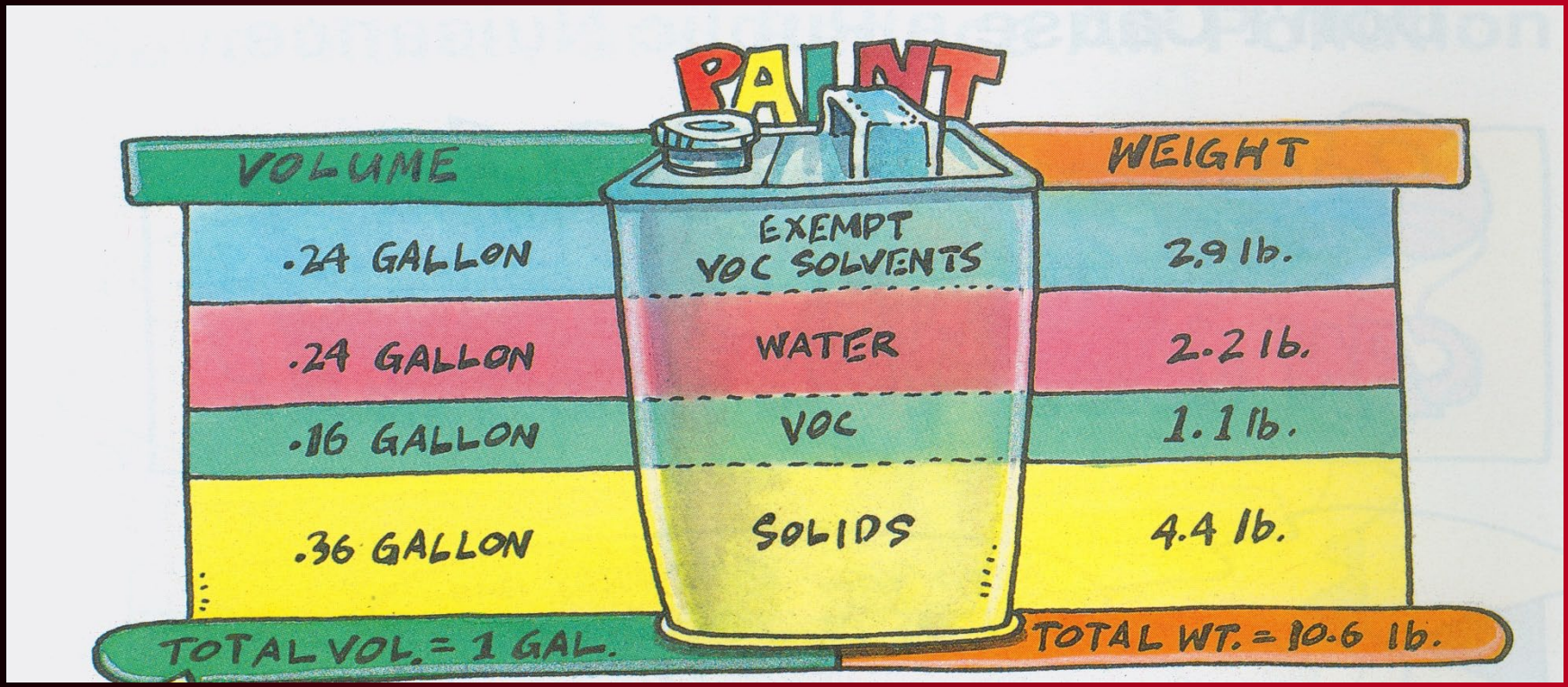
What is the HAP content of this coating?



1.1 lbs + 2.9 lbs (voc + exempts)

_____ = 11.1 lbs/gal

.36 gal

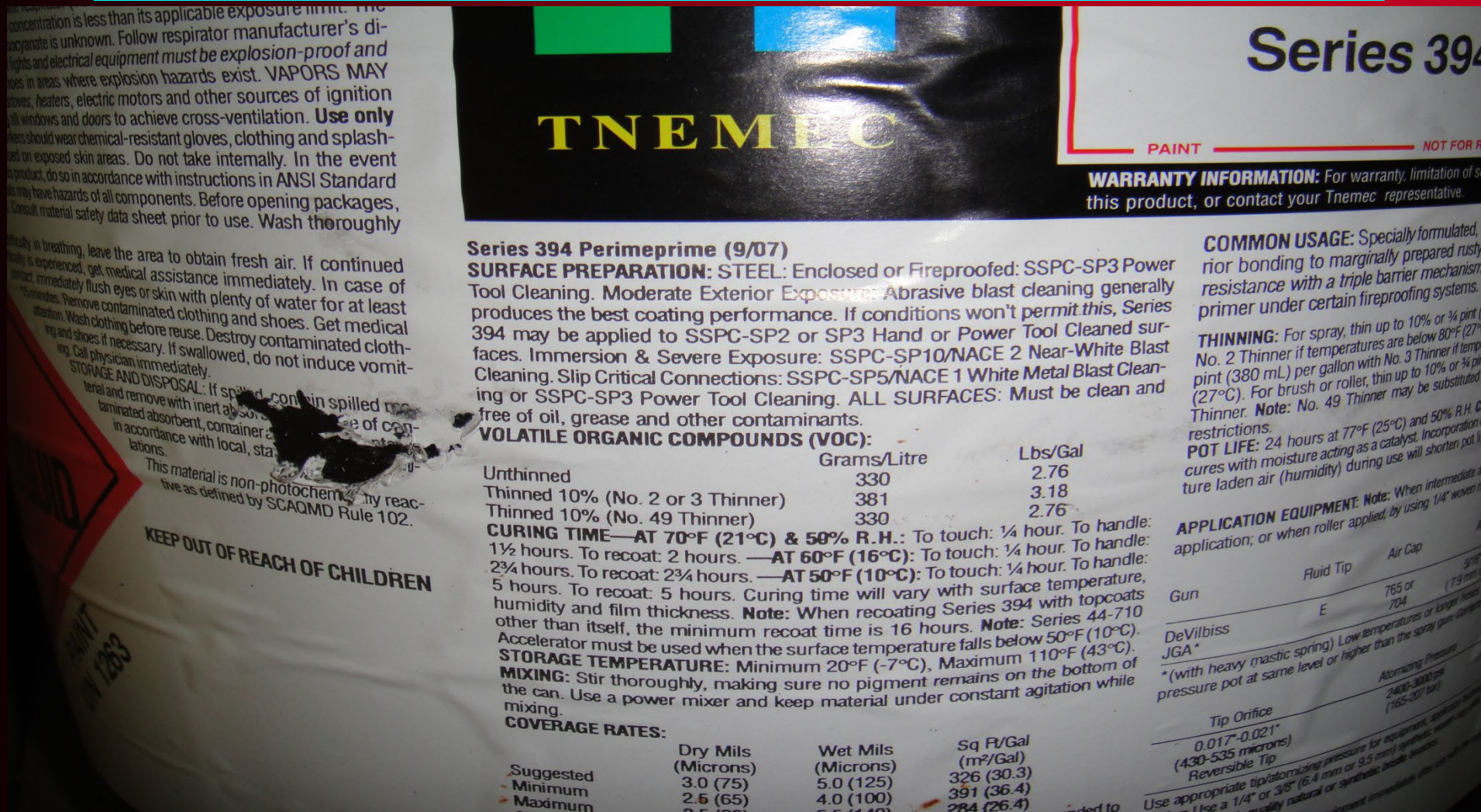


1.1 lbs + 2.9 lbs (voc + exempts)

——————————————————— = 11.1 lbs/gal

1 – [2.9/(2.9/.24)] – [2.2/(2.2/.24)] – [1.1/(1.1/.16)]

A Real World Application



concentration is less than its applicable exposure limit. The isocyanate is unknown. Follow respirator manufacturer's di-
lights and electrical equipment must be explosion-proof and
es in areas where explosion hazards exist. VAPORS MAY
stoves, heaters, electric motors and other sources of ignition
all windows and doors to achieve cross-ventilation. **Use only**
kers should wear chemical-resistant gloves, clothing and splash-
ect on exposed skin areas. Do not take internally. In the event
s product, do so in accordance with instructions in ANSI Standard
es may have hazards of all components. Before opening packages,
Consult material safety data sheet prior to use. Wash thoroughly

ficulty in breathing, leave the area to obtain fresh air. If continued
culty is experienced, get medical assistance immediately. In case of
contact, immediately flush eyes or skin with plenty of water for at least
15 minutes. Remove contaminated clothing and shoes. Get medical
attention. Wash clothing before reuse. Destroy contaminated cloth-
ing and shoes if necessary. If swallowed, do not induce vomit-
ing. Call physician immediately.
STORAGE AND DISPOSAL: If spilled, contain spilled ma-
terial and remove with inert absorbent. Dispose of con-
taminated absorbent, container and unused contents
in accordance with local, state and federal regu-
lations.
This material is non-photochemically reac-
tive as defined by SCAQMD Rule 102.

KEEP OUT OF REACH OF CHILDREN

TNEMEC

Series 394

PAINT — NOT FOR

WARRANTY INFORMATION: For warranty, limitation of s
this product, or contact your Tnemec representative.

Series 394 Perimeprime (9/07)

SURFACE PREPARATION: STEEL: Enclosed or Fireproofed: SSPC-SP3 Power Tool Cleaning. Moderate Exterior Exposure: Abrasive blast cleaning generally produces the best coating performance. If conditions won't permit this, Series 394 may be applied to SSPC-SP2 or SP3 Hand or Power Tool Cleaned surfaces. Immersion & Severe Exposure: SSPC-SP10/NACE 2 Near-White Blast Cleaning. Slip Critical Connections: SSPC-SP5/NACE 1 White Metal Blast Cleaning or SSPC-SP3 Power Tool Cleaning. ALL SURFACES: Must be clean and free of oil, grease and other contaminants.

VOLATILE ORGANIC COMPOUNDS (VOC):

	Grams/Litre	Lbs/Gal
Unthinned	330	2.76
Thinned 10% (No. 2 or 3 Thinner)	381	3.18
Thinned 10% (No. 49 Thinner)	330	2.76

CURING TIME—AT 70°F (21°C) & 50% R.H.: To touch: ¼ hour. To handle: 1½ hours. To recoat: 2 hours. —**AT 60°F (16°C):** To touch: ¼ hour. To handle: 2¾ hours. To recoat: 2¾ hours. —**AT 50°F (10°C):** To touch: ¼ hour. To handle: 5 hours. To recoat: 5 hours. Curing time will vary with surface temperature, humidity and film thickness. **Note:** When recoating Series 394 with topcoats other than itself, the minimum recoat time is 16 hours. **Note:** Series 44-710 Accelerator must be used when the surface temperature falls below 50°F (10°C).

STORAGE TEMPERATURE: Minimum 20°F (-7°C), Maximum 110°F (43°C).

MIXING: Stir thoroughly, making sure no pigment remains on the bottom of the can. Use a power mixer and keep material under constant agitation while mixing.

COVERAGE RATES:

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	3.0 (75)	5.0 (125)	326 (30.3)
Minimum	2.5 (65)	4.0 (100)	391 (36.4)
Maximum			284 (26.4)

COMMON USAGE: Specially formulated, rior bonding to marginally prepared rusty resistance with a triple barrier mechanism primer under certain fireproofing systems.

THINNING: For spray, thin up to 10% or ¾ pint No. 2 Thinner if temperatures are below 80°F (27 pint (380 mL) per gallon with No. 3 Thinner if temp (27°C). For brush or roller, thin up to 10% or ¾ pi Thinner. **Note:** No. 49 Thinner may be substituted restrictions.

POT LIFE: 24 hours at 77°F (25°C) and 50% R.H. C cures with moisture acting as a catalyst. Incorporation ture laden air (humidity) during use will shorten pot l

APPLICATION EQUIPMENT: Note: When intermediate application; or when roller applied, by using 1/4" woven

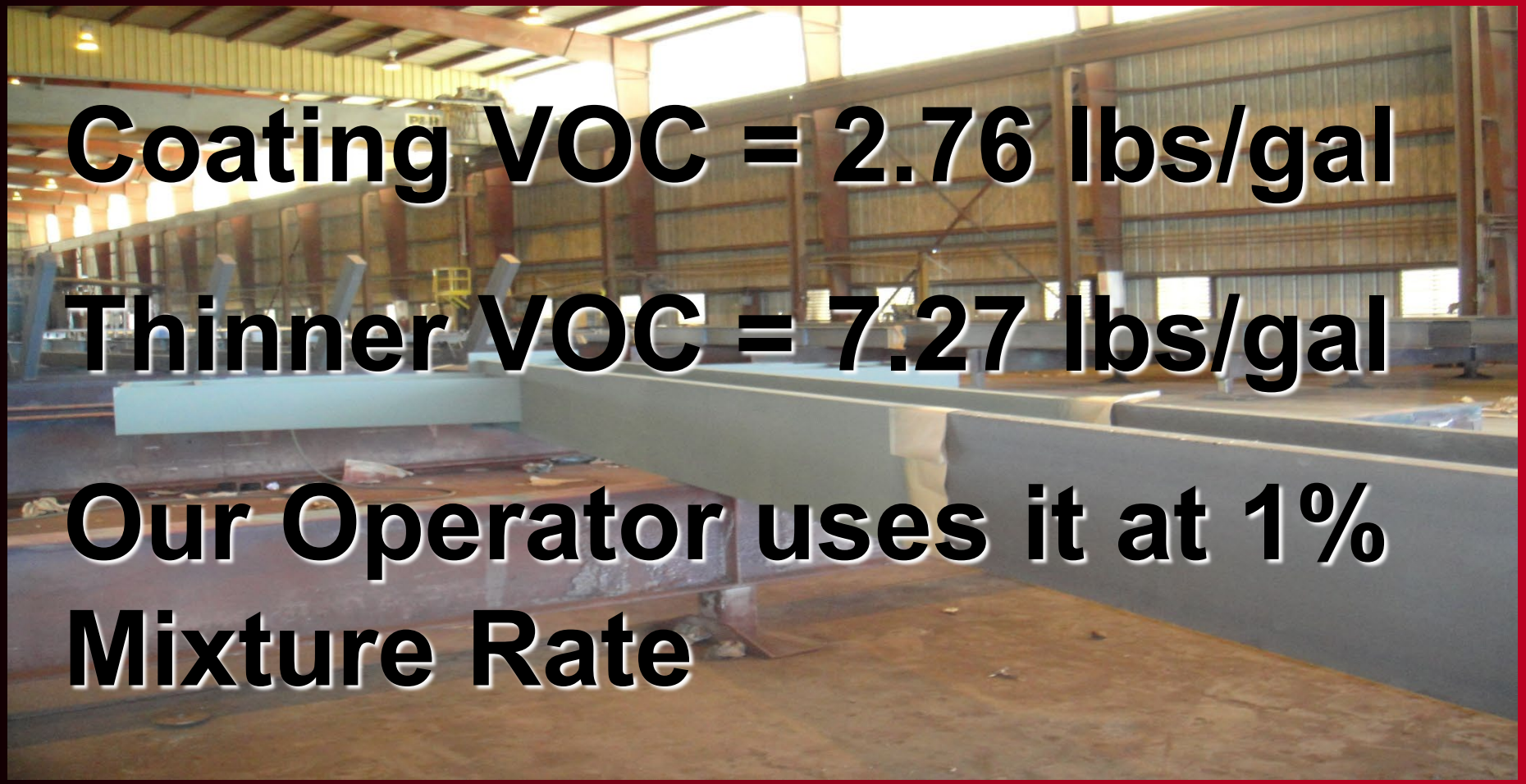
Gun	Fluid Tip	Air Cap	Atomizing Pressure
DeVilbiss JGA*	E	765 or 704	5/16" (7.9 mm) 2400-3000 psi (165-207 bar)

*(with heavy mastic spring) Low temperatures or longer hose pressure pot at same level or higher than the spray gun.

Tip Orifice	
0.017"-0.021" (430-535 microns) Reversible Tip	Use appropriate tip/atomizing pressure for equipment,

Use a 1/4" or 3/8" (6.4 mm or 9.5 mm) synthetic
quality natural or synthetic bristle brushes.

Time for Calculations



Coating VOC = 2.76 lbs/gal

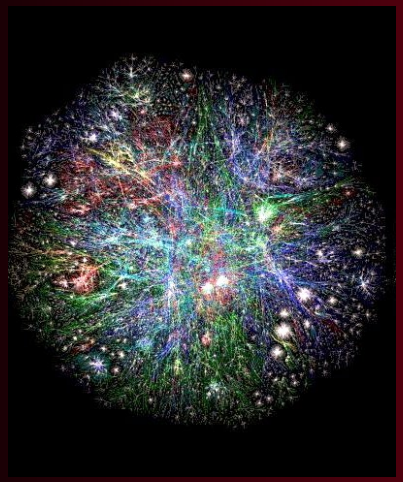
Thinner VOC = 7.27 lbs/gal

Our Operator uses it at 1% Mixture Rate

Time for Calculations

7.27 X .01 = .0727 lbs/gal VOC @ 1% Mixture Ratio

2.76 lbs/gal x .99 = 2.73 + .0727 = 2.80 lbs/gal



Websites

- epa.gov/stationary-sources-air-pollution/national-emission-standards-hazardous-air-pollutants-neshap-9
- epa.gov/collision-repair-campaign
- nmfrc.org/
- ccar-greenlink.org
- paintcenter.org/

Questions?