EPA Design for the Environment (DfE) Training:
Best Practices for Auto Refinishing

Presented by:

DfE Auto Refinish Project Team:

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- Overview of DfE Project, Goals, Findings, Outreach Efforts
- Hazardous Air Pollutants and VOCs in Collision Repair
- Key Chemicals of Concern
- Health/Environmental Effects

- Tour of Virtual Auto Body Shop

  www.ccar-greenlink.org/cshops

Overview & Goals - DfE Project

www.epa.gov/dfe/pubs/projects/auto

- Partnership with collision repair industry
- Encourage best practices and technologies to reduce risk/pollution
- Focus on spray painting and other activities that release toxic chemicals
- Tools: site visits, workshops, outreach kit -binder/CD, self-evaluation checklist, DfE and virtual auto body shop websites

Findings - Best Practices Shop Visits: A Success

- Over 100 shop and school site visits; numerous workshops across country
- 81% of shops made changes
- Changes include:
  - improved use of HVLP spray guns
  - reduced shop emissions
  - better respiratory protection for painters
  - improved mixing room ventilation
  - all spraying in booth, including priming

Profile of Auto Refinish Industry

- 47,000 shops; >190,000 technicians
  - 14% small (<$300,000)
  - 49% large ($300,000 - $1million)
  - 37% super (>$1 million)

  (Data from 2007 I-CAR Education Foundation Survey)
- Numerous high school and community college programs
- Shops/schools use & release harmful chemicals
- Emissions may pose risks to those in the shops/schools and nearby residents

Outreach Efforts

- Identify factors that motivate change
  - lower costs (less paint, less waste)
  - similar or better performance
  - cleaner, healthier work environment
  - easier to comply with new regulations
  - recognition as environmental leader
- Develop useful tools
- Build a network of support

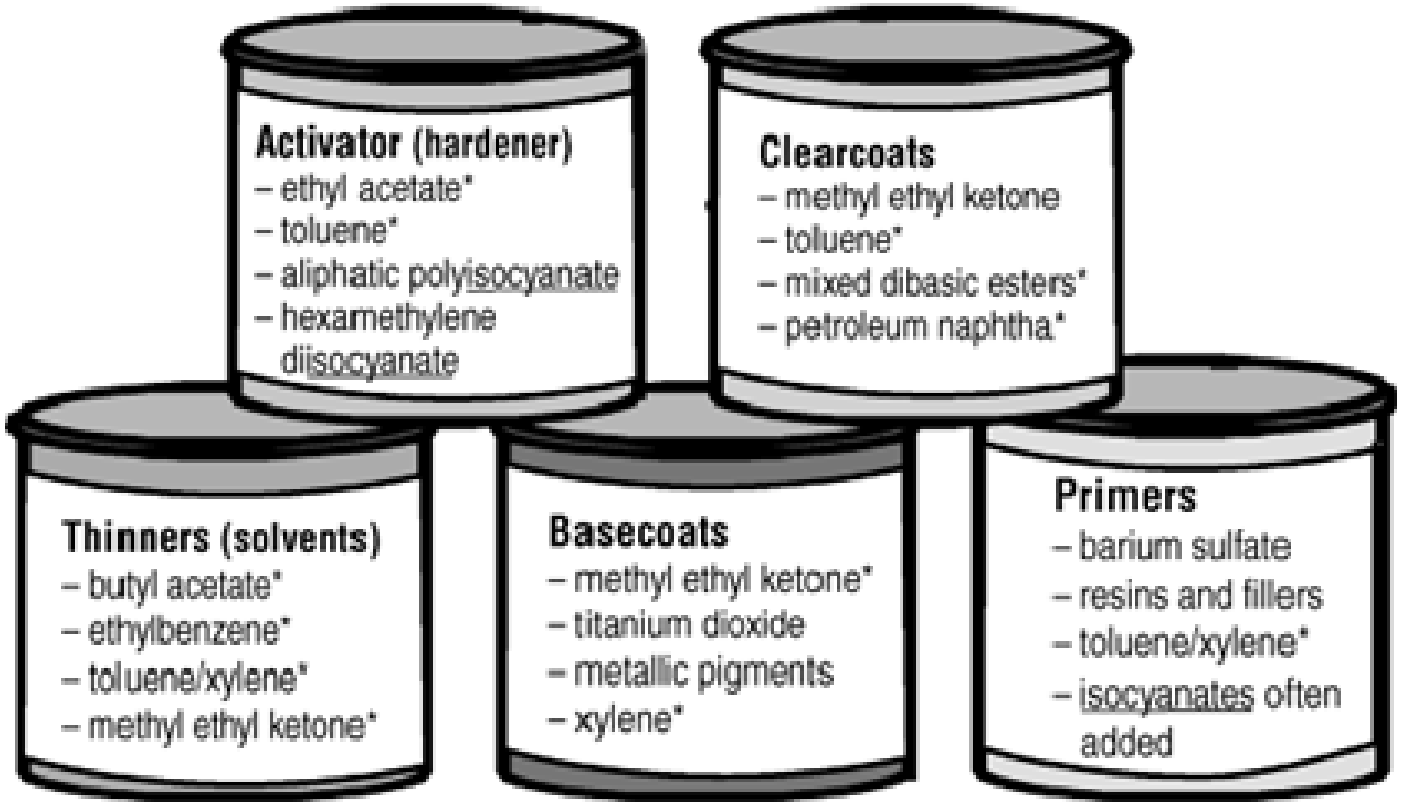
New EPA Regulations

- Compliance date – 2011 (for existing shops)
- Includes a number of best practices
  - All paint spray application in a filtered booth or prep station
  - HVLP or equivalent spray guns
  - Painter training & certification
  - Gun cleaning requirements
- Record keeping and notification

HAPs, VOCs, and Other Chemicals of Concern in Collision Repair

- HAPs = hazardous air pollutants (188)
  - Heavy metals, organic solvents, HDI
- VOCs = volatile organic compounds
  - Organic solvents
- Other chemicals of concern
  - HDI polyisocyanates

Chemicals of Concern in Paint Products



Diisocyanates

- Diisocyanates
  - Hexamethylene diisocyanate (HDI)
  - HDI polyisocyanate
  - (also TDI, MDI, and other diisocyanates)

- Potential exposures
  - spray mist (primers, clear coats)
  - sanding dusts
  - welding and soldering fumes of urethane coatings

Diisocyanates – Why should we be concerned?

- Leading cause of work-related asthma
- Can cause allergic reactions
- Skin and lung sensitizers
- National Institute for Occupational Safety and Health (NIOSH) ALERTS
  - 2006 Spray-on truck bed lining operations
  - 1996 Warning on asthma & death with exposures
- New lower Canadian air standards (2006)
- Toluene diisocyanate (TDI) is a probable human carcinogen

Heavy Metals

- Chromium, Lead, Manganese, Nickel, Cadmium (target HAPs in new EPA regulation)
- Potential exposures
  - sanding dusts
  - spray mists (paint pigments, corrosion protection for metal surfaces)
  - undercoating
  - welding fumes

Heavy Metals - Why should we be concerned?

- Chromium VI (hexChrome)
  - lung cancer; irritation of eyes, nose, throat, lungs; skin & lung sensitization
  - new OSHA standard (lowered exposure limit from 50 ug/m^3 to 5 ug/m^3)
- Lead:
  - muscle and joint pain; irritability
  - memory and concentration problems
  - fertility problems; anemia; kidney damage
  - nerve, and brain damage

Organic Solvents

- Toluene, xylenes, methyl ethyl ketone, ethyl benzene, others
- Potential Exposures
  - thinners, solvent wipe-down
  - paint mixing
  - cleaning equipment
  - hazardous waste handling/disposal

Organic Solvents – Why should we be concerned?

- Health effects include:
  - irritation; headache, nausea
  - liver, kidney, blood effects
  - central nervous system damage
  - reproductive effects (recent Dutch study)
- Ethyl benzene is a probable human carcinogen

Virtual Auto Body Shop

www.ccar-greenlink.org/cshops

A Painter's Perspective on Best Practices

Making Change: A Personal Decision

- 25 years experience in the industry
- Motivation to change as an individual
  - Personal health
  - Family
  - Monetary benefits (both as shop manager and painter)
  - Professional pride
- Motivation to improve the industry
  - Support the DfE team's efforts to help the industry
  - Share experience on overcoming challenges
  - Industry offers great professional opportunity for young painters

Best Practices and Technologies that Reduce Exposures/Emissions

What is wrong with this picture?

Key Exposure & Release Points

- Spray Painting - exposure to paint mist containing solvents, diisocyanates, lead chromate, paint additives
- Paint Mixing - solvent exposure; inadequate ventilation
- Preparation & Clean Up - dust, solvent exposure

Key Best Practices That Reduce Emissions

- Perform all spray painting in spray booth
- Use HVLP spray guns or equivalent
- Use safer alternative paints and cleaning products

Key Best Practices (contd.)

- Properly ventilate paint mixing room
- Use appropriate respiratory protection
- Wear chemical-resistant gloves, clothing, eye protection
- Manage health & safety responsibly

DfE Site Visit Binder

The binder contains:

- Best practices checklist for each activity
- Best practices fact sheets and case studies for selected activities
- List of manufacturers and suppliers
- Information on isocyanates
- Video on working safely with polyurethane paints

Best Practices - Benefits

- Cleaner, more productive shop
- Healthier painter, fewer lost sick days
- Reduced paint & solvent emissions
- Paint cost savings
- Waste reduction

Spray Painting Best Practices

- Perform all spraying activities in a well maintained ventilated spray booth. Booth types include:
  - Downdraft
  - Semi-downdraft
  - Crossdraft
- Spray booth filters are 98% efficient for particulates

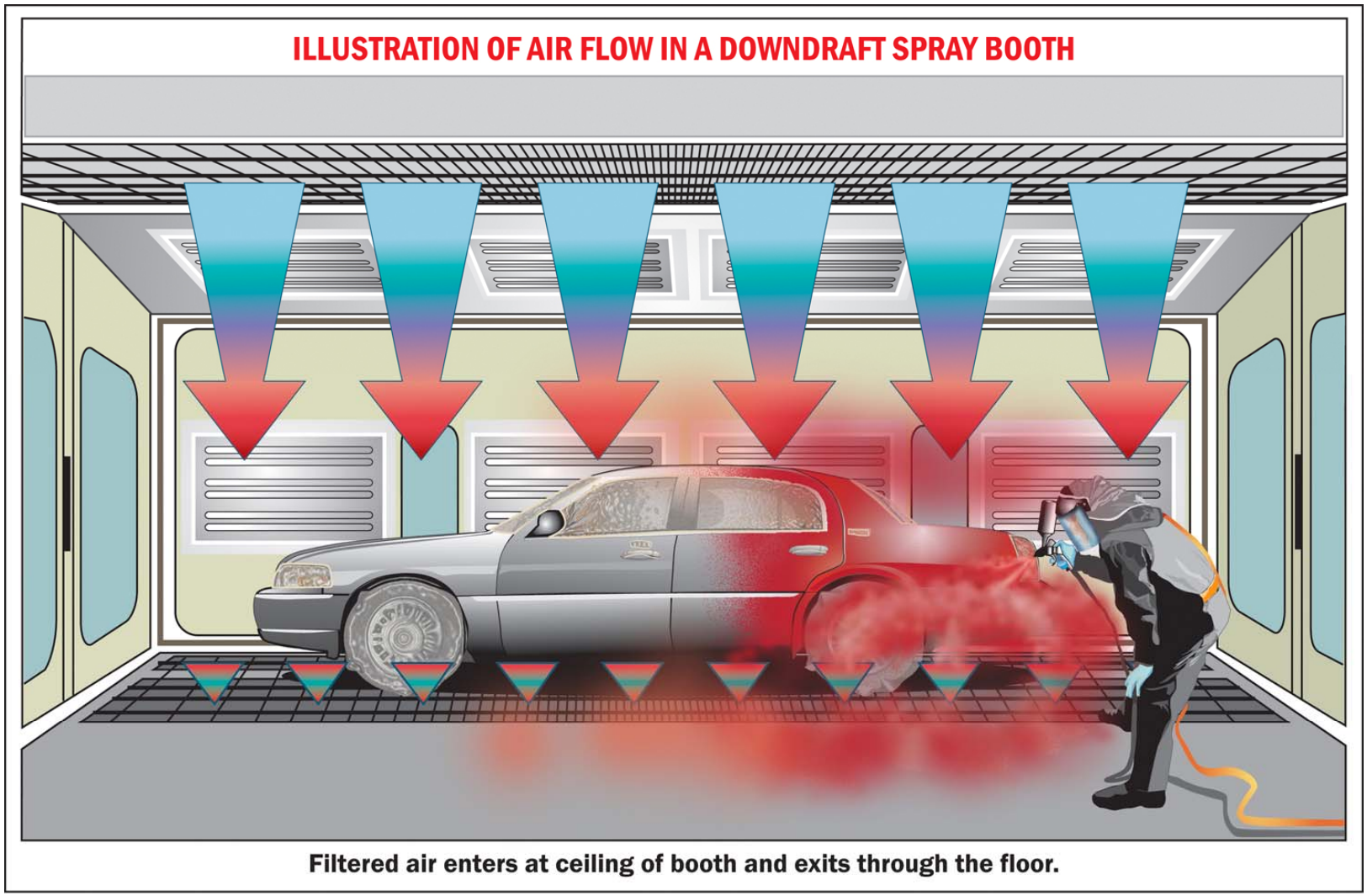


ILLUSTRATION OF AIR FLOW IN A DOWNDRAFT SPRAY BOOTH
Filtered air enters at ceiling of booth and exits through the floor.

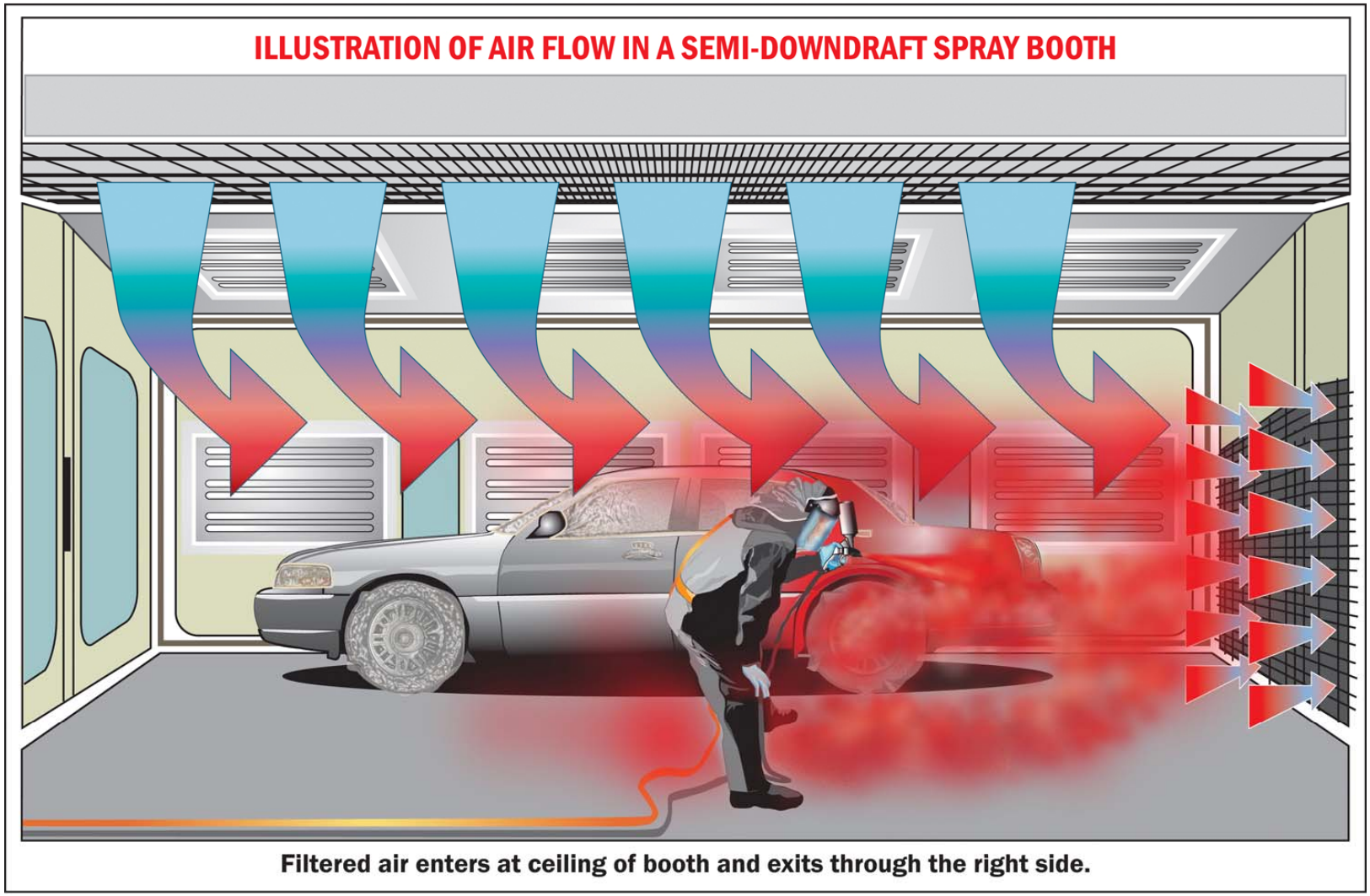
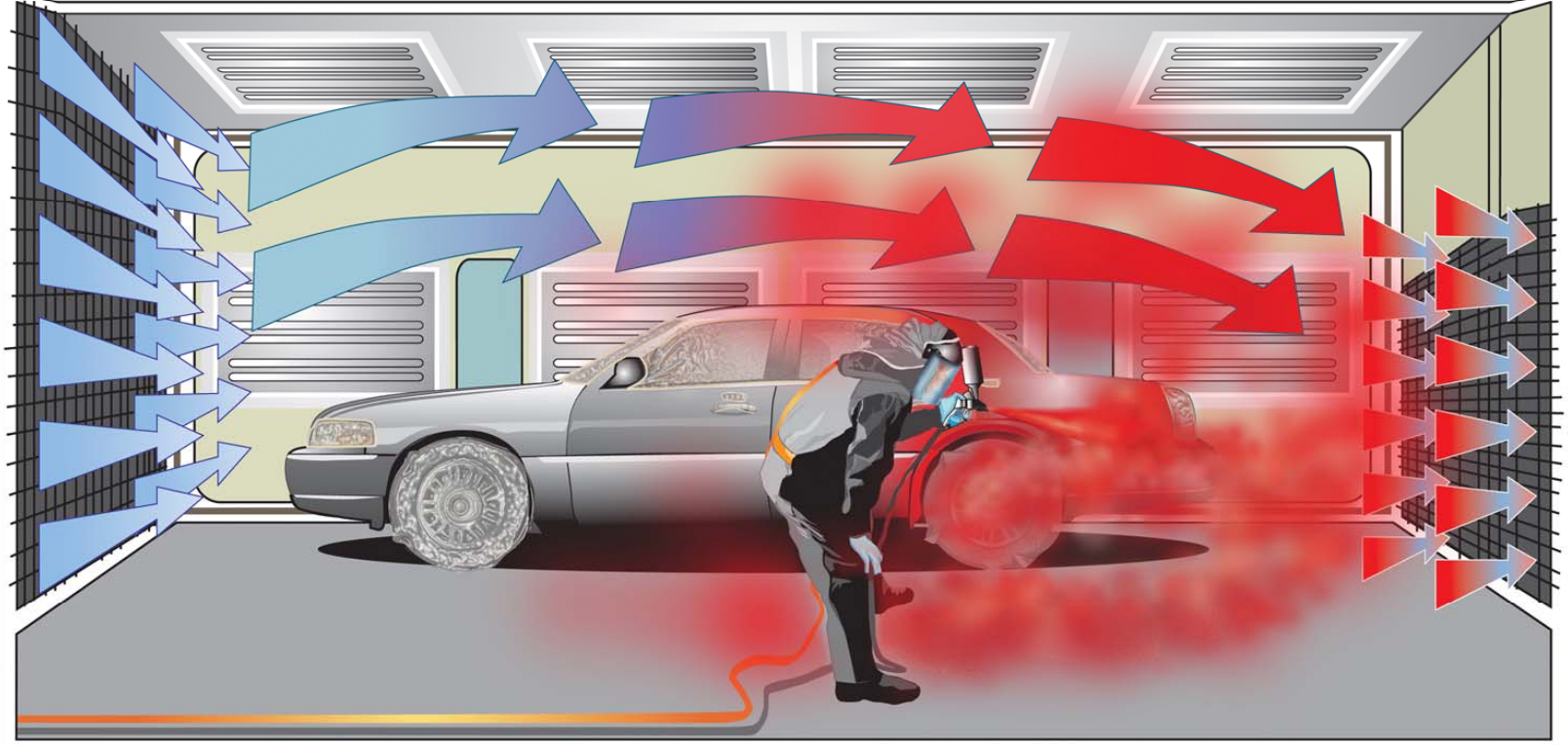


ILLUSTRATION OF AIR FLOW IN A SEMI-DOWNDRAFT SPRAY BOOTH
Filtered air enters at ceiling of booth and exits through the right side.

ILLUSTRATION OF AIR FLOW IN A CROSSDRAFT VENTILATION SPRAY BOOTH



Filtered air enters at left side of booth and exits through right side.

OSHA and EPA Spray Booth Requirements

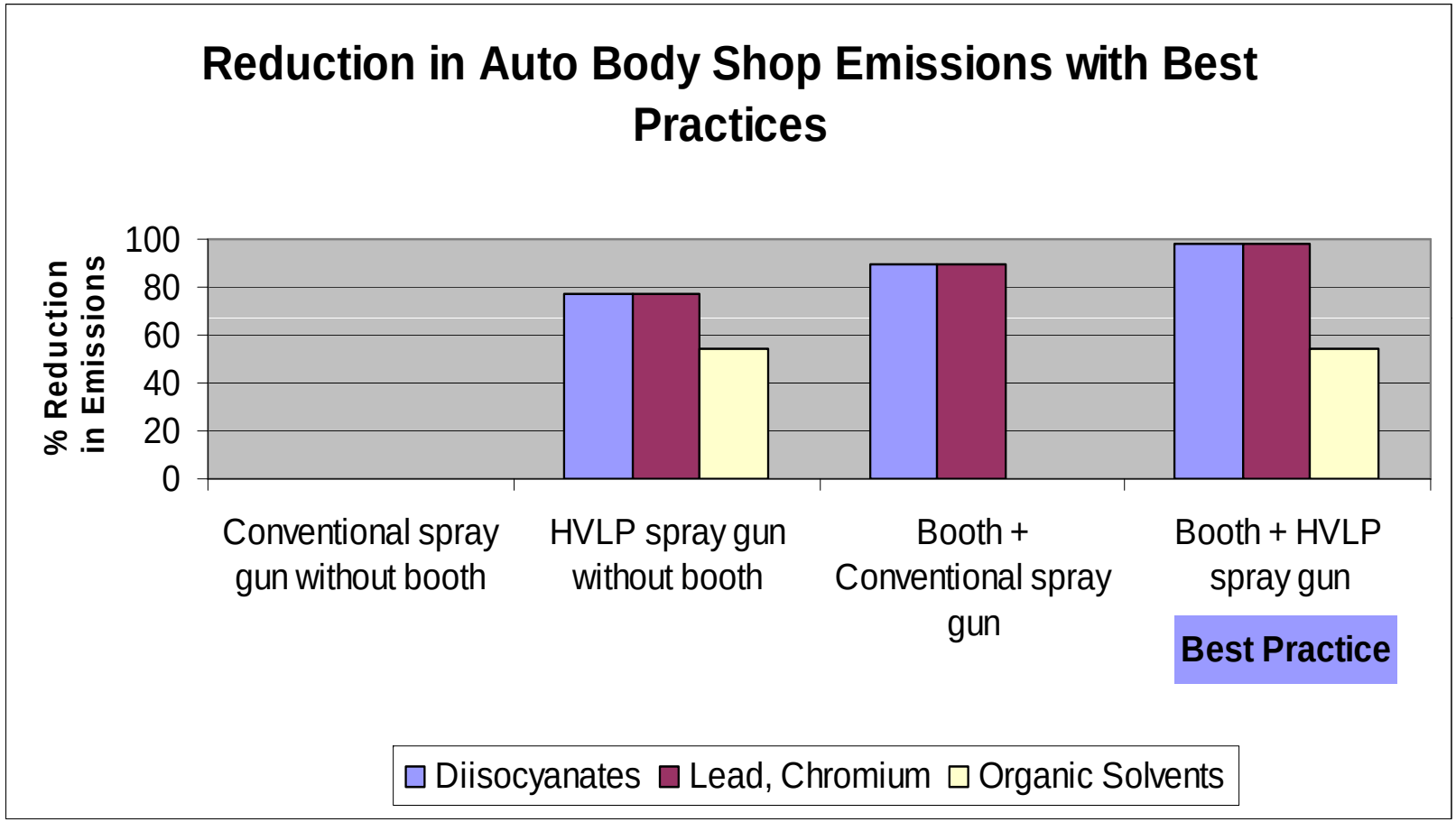
EPA	OSHA
Booth filters at least 98-percent efficient in capturing overspray. [40 CFR Part 63.11173(e)(2)(i)]	Perform all spray applications in a spray booth or spray room. [29 CFR 1910.94(c)(2)]
Complete motor vehicles in a fully enclosed booth or prep station (4 walls or side curtains). [40 CFR Part 63.11173(e)(2)(ii)]	
Perform spray painting of parts or sub assemblies in a booth or prep station with at least 3 walls or side curtains. [40 CFR Part 63.11173(e)(2)(iii)]	

<u>Standards and regulations that address the design/construction,/location of spray booths</u>:

1. EPA: National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources, 40 CFR Part 63.11173(e)(2)
2. OSHA: Ventilation, 29 CFR 1910.94(c)(3)
3. OSHA: Spray Finishing Using Flammable and Combustible Materials, 29 CFR 1910.107(b)(1) through (b)(4) and (b)(6) through (b)(10).
4. NFPA: Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA 33
5. ANSI**:** Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems, ANSI Z9.2.

Spray Painting Best Practices
Safer Alternative Paints/Products

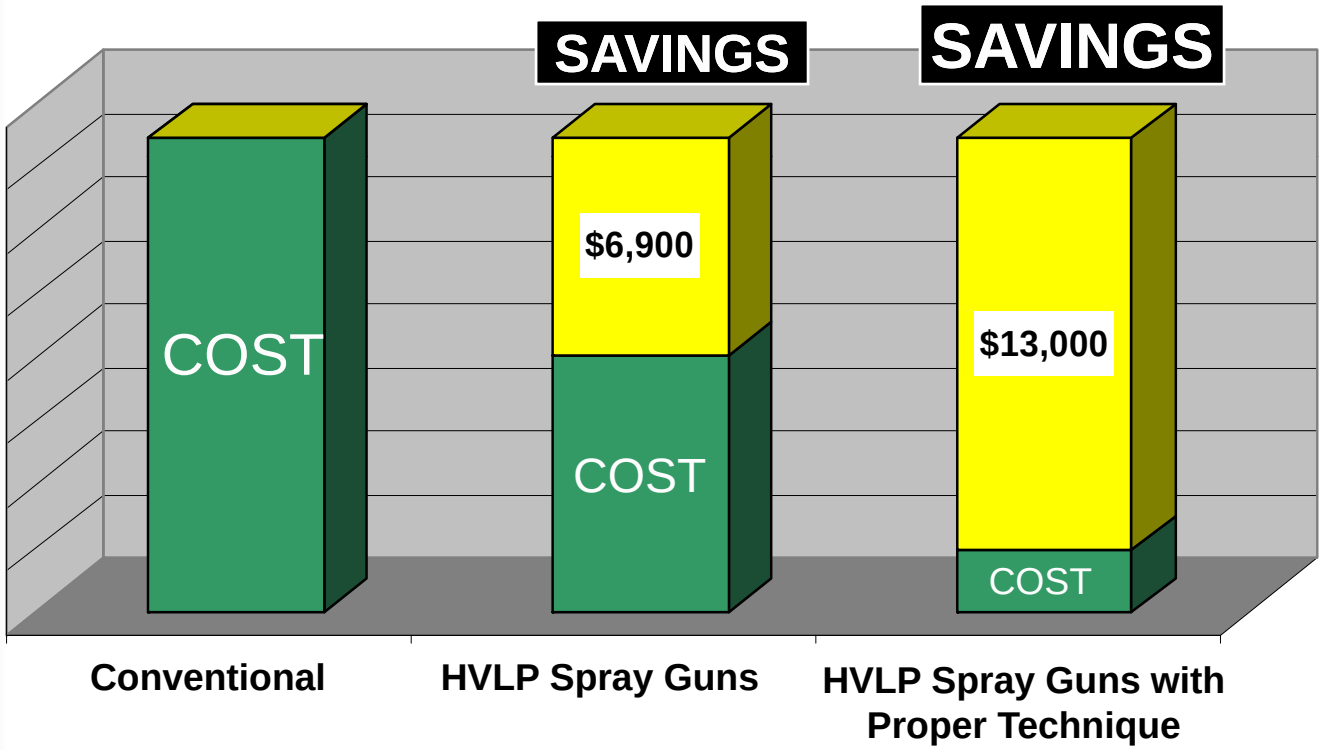
- Use safer alternative paints and cleaning products
  - Consider switching to waterborne paints
  - Substitute topcoats and undercoats with chrome- and lead-free alternatives
  - Use low VOC, zero HAPs cleaning solvents


Reduction in Auto Body Shop Emissions with Best Practices
% Reduction in Emissions
100
80
60
40
20
0
Conventional spray gun without booth
HVLP spray gun without booth
Booth + Conventional spray gun
Booth + HVLP spray gun
Best Practice
Diisocyanates
Lead, Chromium
Organic Solvents

Spray Painting Best Practices HVLP Spray Guns

- Use High Volume Low Pressure (HVLP) spray guns
  - Increase transfer efficiency (up to 65%) and reduce overspray
  - Reduce shop emissions
  - Reduce worker exposure
  - Reduce paint volume needed for each job, resulting in savings for shops

Paint Cost Savings with HVLP Spray Guns



* Estimated annual savings, based on 420 gal/yr
Courtesy of the STAR Program, IWRC

Tips for Effective Use of HVLP Spray Guns

- Use a larger diameter air hose
- Use the right gun tip for the job
- Ensure that shop compressor is capable of delivering sufficient air
- Set up each gun to ensure proper pressure at the gun tip
- Use proper spraying techniques

Prep Work Best Practices

Sanding

- Use Vacuum sanding system (dry sanding)
- Use a well ventilated area, such as a prep station (dry sanding)

Solvent Wipe Down

- Use spray booth, or prep station, or other source of ventilation; consider substitute solvent

Spray Gun Cleaning Best Practices

- Use an automatic gun cleaning unit
- Pre-clean guns to remove gross contamination
- Cover gun cleaning unit when possible
- Ensure that gun cleaning unit is in good working order
- Consider substitute cleaning compounds

Spray Gun Cleaners

Enclosed Automatic Paint Gun Washer

Recirculating Paint Gun Cleaning System

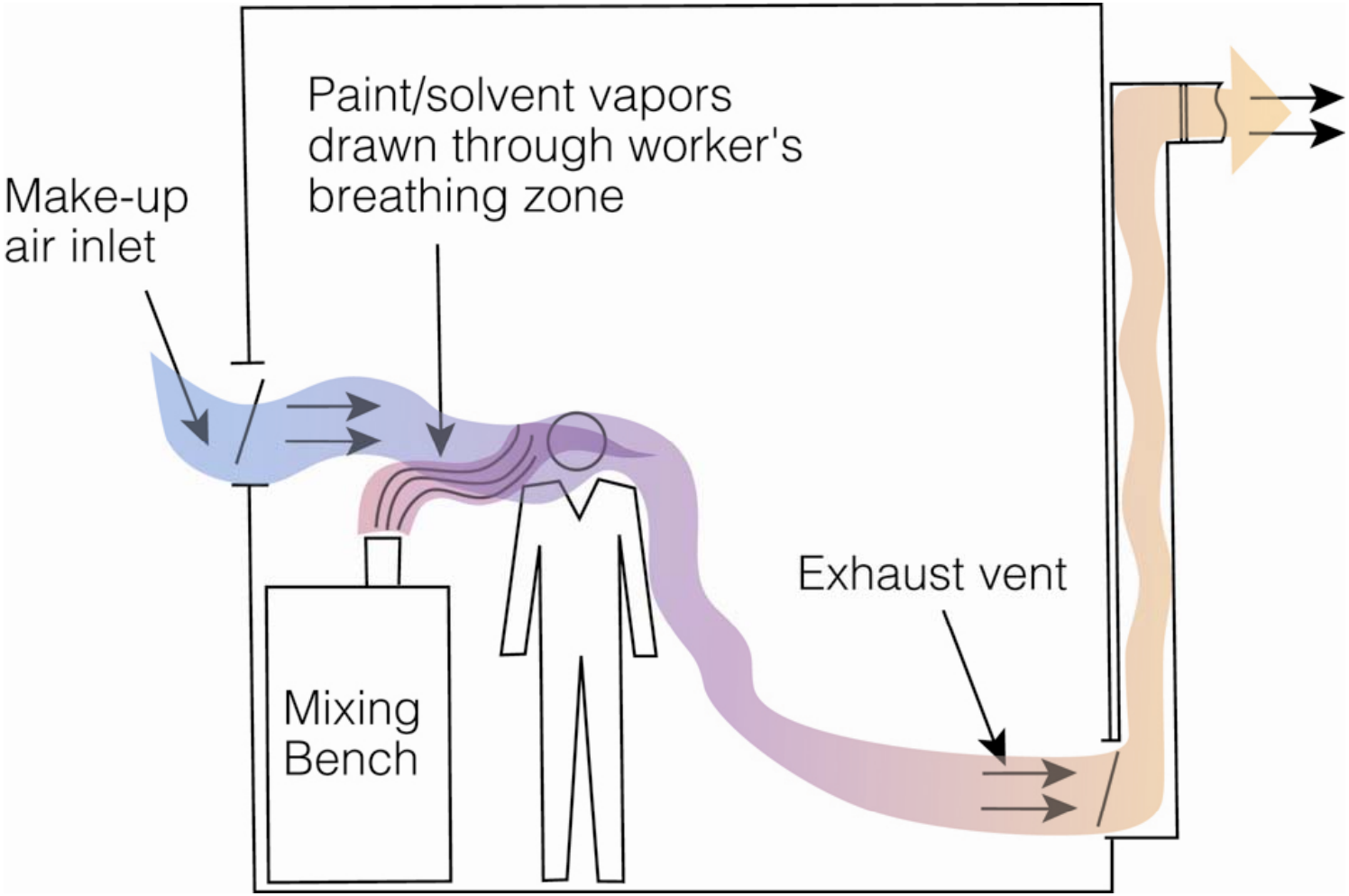
Minimizing Hazardous Waste

- Solvent recyclers
- Spray gun cleaners that reuse cleaning solvents
  - Proper cleaning techniques
- Computerized mixing system
- Mix only what is needed
- Store and reuse remaining mixed paint

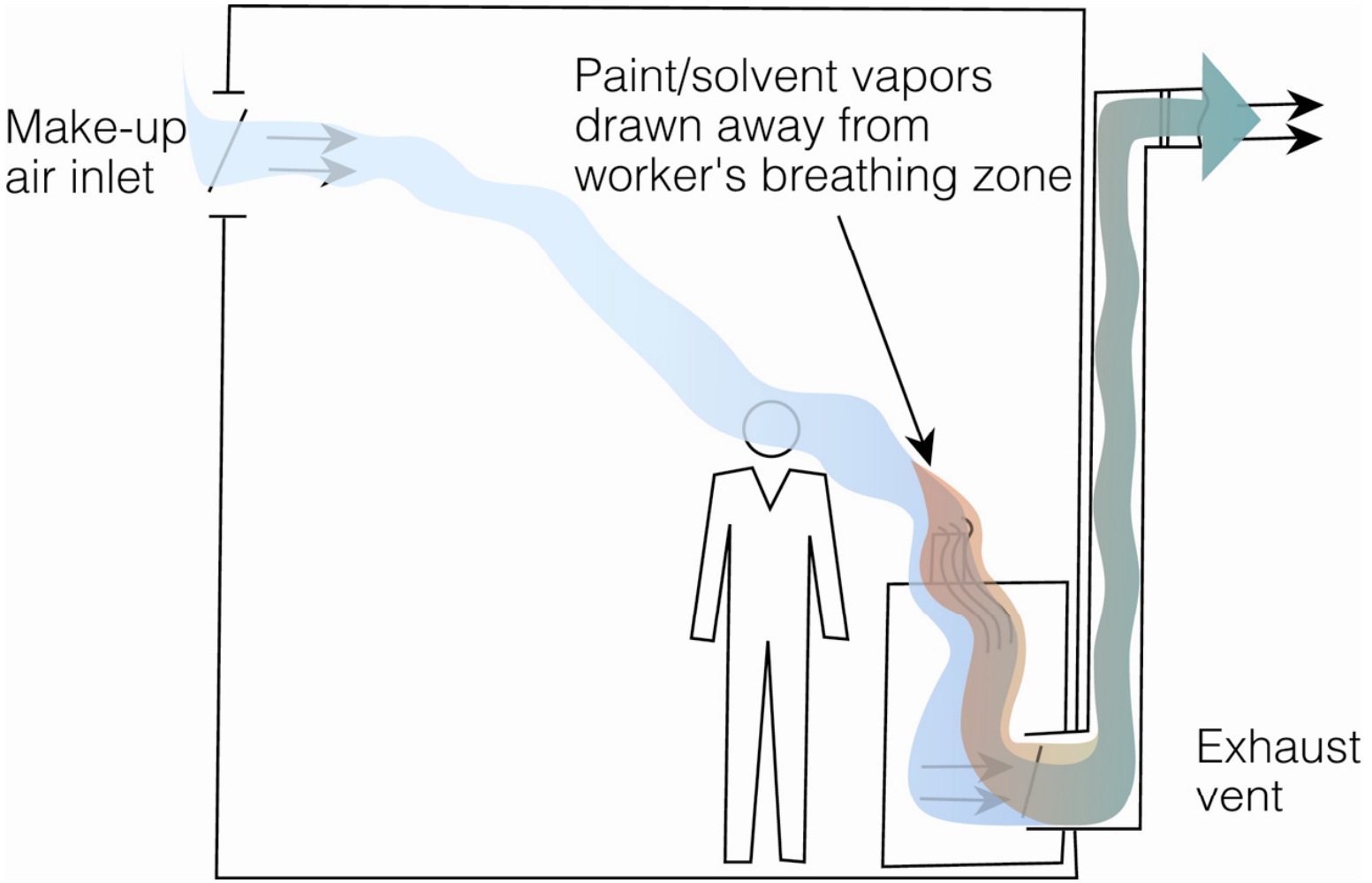
Paint Mixing Best Practices

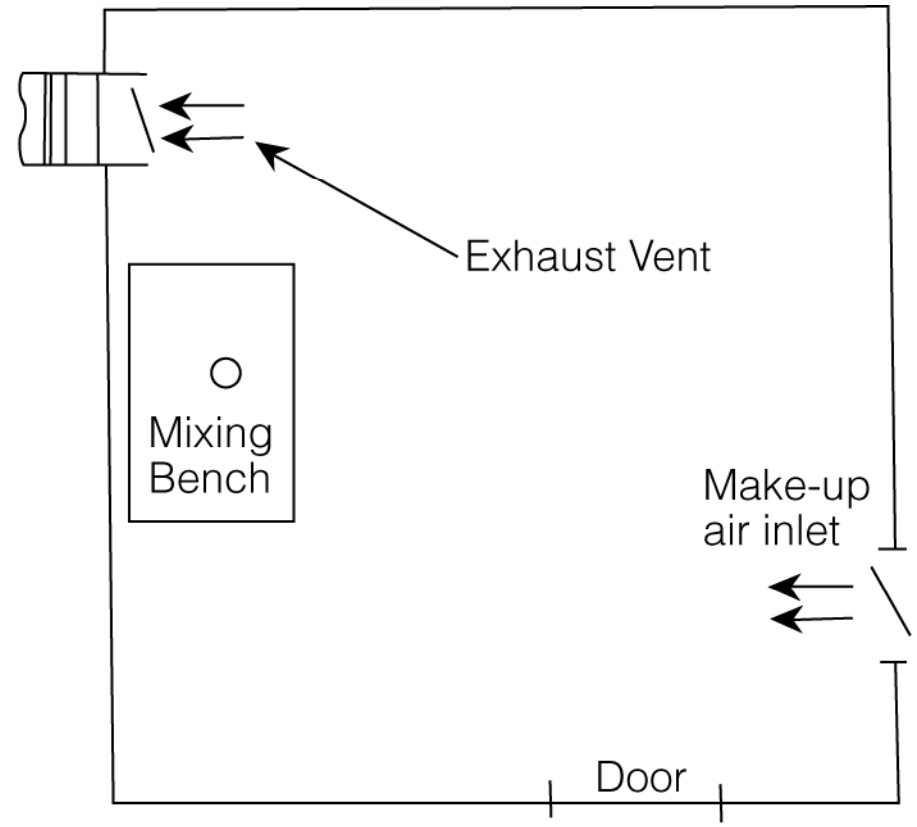
- Provide adequate ventilation in paint mixing area. Local exhaust vents should be located near sources of emissions
- Keep all containers shut when not in use. Use gasket-sealed, spring-loaded covers on solvent storage containers and waste drums

Poor Ventilation Design

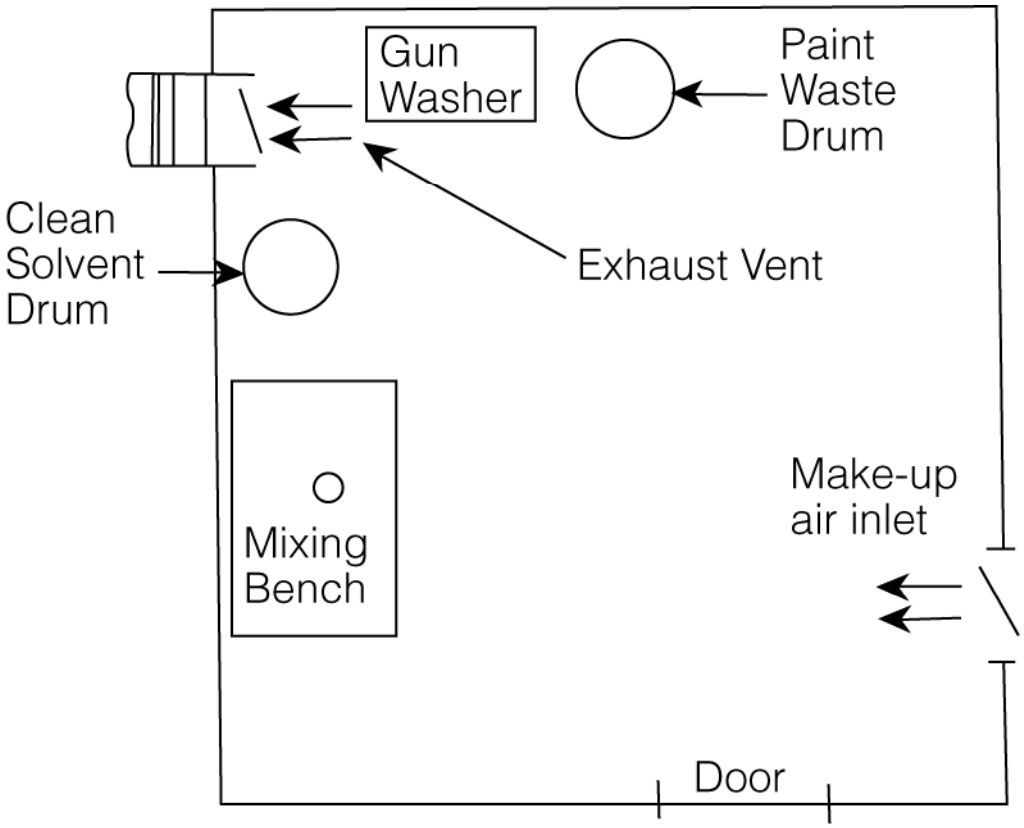


Draw vapors away from breathing zone

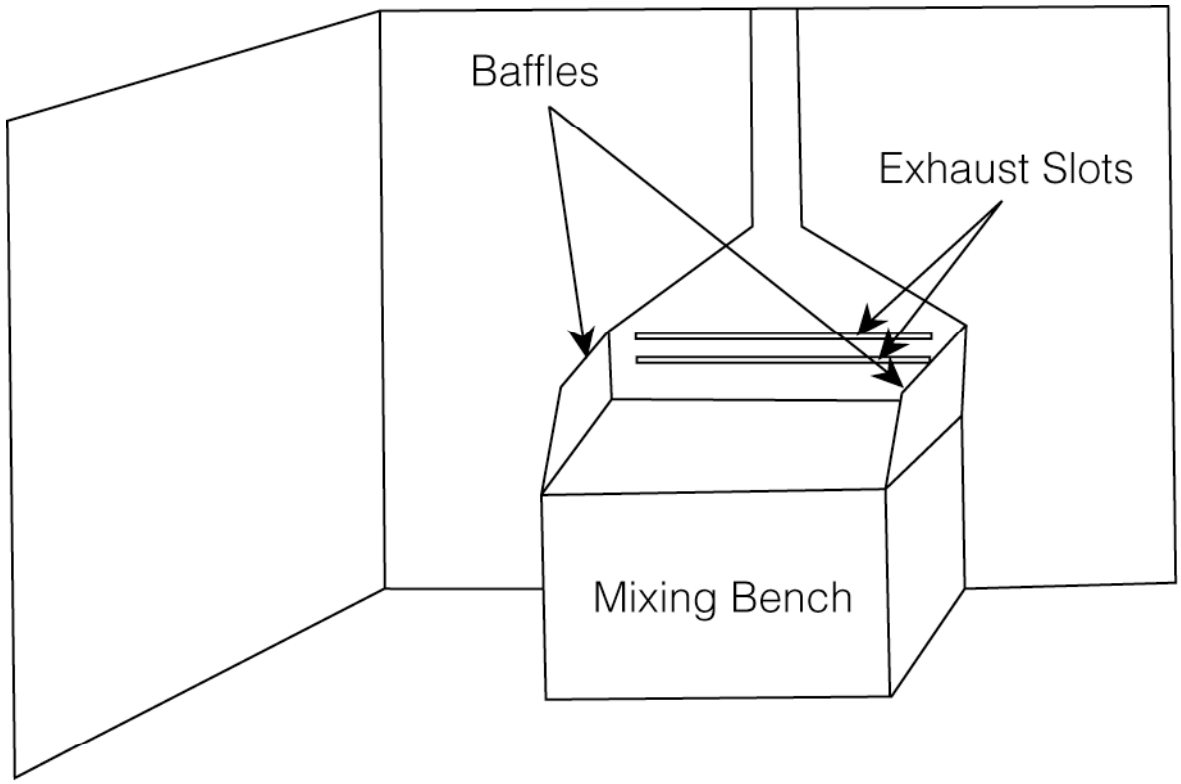




Top view of room—Locate
make-up air inlet opposite from exhaust vent



Top view of room—
Locate exhaust vent near vapor sources



Local exhaust ventilation

Virtual Auto Body Shop
Paint Mixing Room

www.ccar-greenlink.org/cshops

Health and Safety Management in the Collision Repair Shop/School

Personal Protective Equipment (PPE)

Task	PPE
Spray Painting	A loose-fitting SAR or better (APF of at least 25).
	Protective gloves (nitrile or manufacturer suggested gloves).
	Protective eyewear.
	Coveralls and headsock.
Paint Mixing, Solvent Wipe Down, Spray Gun Cleaning	A half-mask APR with organic vapor cartridges or better.
	Protective gloves (nitrile or manufacturer suggested gloves).
	Protective eyewear.
Sanding	A loose-fitting SAR or better (APF of at least 25).
	A half-mask APR with N95 particulate filter or better (dry sanding).

User-Friendly Respirators

- Loose-fitting hood supplied-air respirators
  - Light-weight, low-maintenance
  - Do not need a fit test to use
  - Can even have a beard and wear eyeglasses
  - Often provide the greatest cooling effect
- Tight-fitting facepiece supplied-air respirators
  - Typically provide the highest level of protection
  - Rear-mount model helps prevent contact with the paint job
  - Painters need a fit-test and cannot have beard/ facial hair
  - Eyeglass mounts available with most models
- Select the type of respirator that works best for the shop and its painters

Grade D Breathing Air

- Grade D breathing air is required for supplied air respirators (OSHA requirement):
  - Oxygen content (v/v) of 19.5-23.5%;
  - Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less
  - Carbon monoxide content of 10 ppm or less
  - Carbon dioxide content of 1,000 ppm or less
  - Lack of noticeable odor
- Grade D breathing air can be provided by:
  - Supplied air respirator fresh air pump
  - The shop air compressor equipped with an appropriate filter and regulator for breathing air and with a carbon monoxide alarm

Health and Safety Management

- Respiratory Protection Program
- Hazard Communication Program

Respiratory Protection Program

The program (required by OSHA)

assures that:

- Shop selects appropriate respirator for the job
- Respirators are used properly and provide the intended level of protection
- Workers are physically capable of wearing selected respirators

Respiratory Protection Program

The program should include:

- A written program
- Use of NIOSH approved respirators
- Medical surveillance
- Annual fit testing
- Training
- Filter change out schedule for APRs

Respirator Fit Test

Hazard Communication Program

This program helps convey information to the shop workers about workplace chemical hazards and how to protect themselves from these hazards.

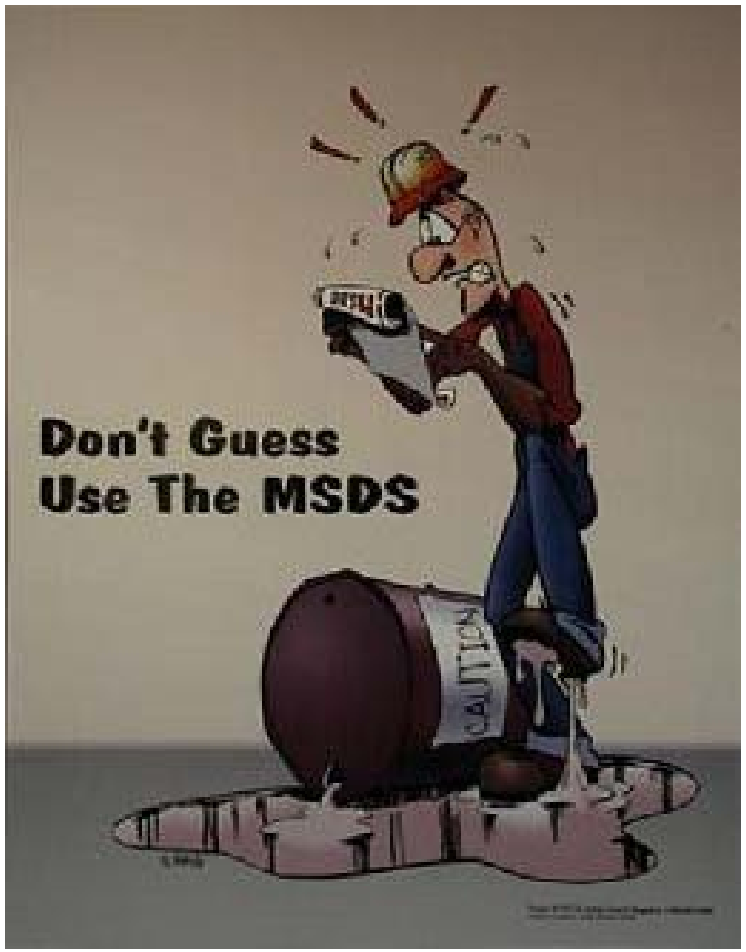
Hazard Communication Program

The program (required by OSHA) must include:

- A written program
- Copies of MSDS for all chemicals in the shop
- Proper labeling of chemicals.
- Training

What is a MSDS?

- A document prepared by the product manufacturer that provides important health and safety information on working with the product.



MSDS Sections

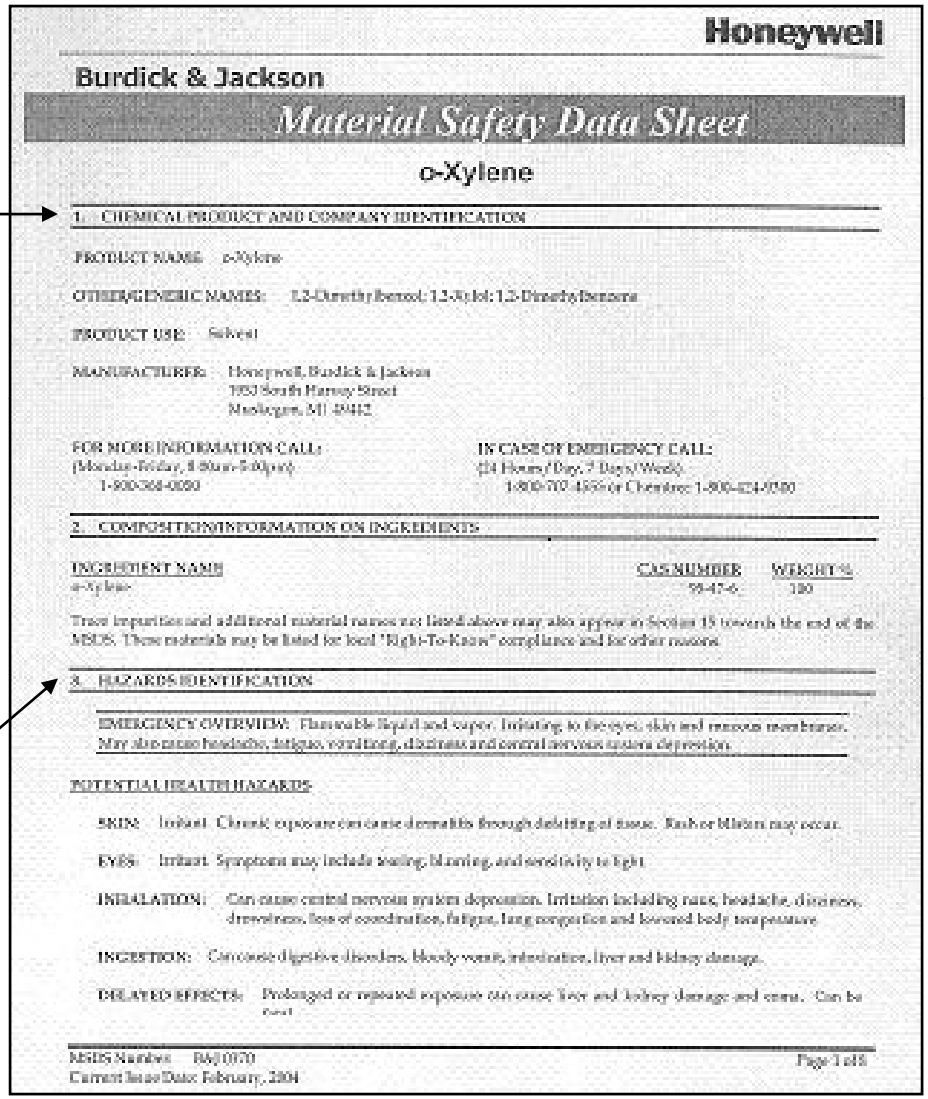
A MSDS consists of 16 sections (in the commonly used ANSI format):

- **Section 1:** Chemical Product and Company Identification
- **Section 2:** Composition, Information on Ingredients
- **Section 3:** Hazards Identification
- **Section 4:** First Aid Measures
- **Section 5:** Fire Fighting Measures
- **Section 6:** Accidental Release Measures
- **Section 7:** Handling and Storage
- **Section 8:** Exposure Controls, Personal Protection
- **Section 9:** Physical and Chemical Properties
- **Section 10:** Stability and Reactivity
- **Section 11:** Toxicological Information
- **Section 12:** Ecological Information
- **Section 13:** Disposal Considerations
- **Section 14:** Transport Information
- **Section 15:** Regulatory Information
- **Section 16:** Other Information

How to Read a MSDS

Section 1: Chemical Product and Company Identification. Names the material and provides a mailing address and telephone number for the manufacturer/distributor (useful in case of an emergency).

Section 3: Hazards Identification. How the chemical enters the body (such as inhaling, swallowing or through the skin) and what health problems it could cause.



Honeywell

Burdick & Jackson

Material Safety Data Sheet

o-Xylene

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: o-Xylene

OTHER/GENERIC NAMES: 1,2-Dimethylbenzol; 1,2-Xylol; 1,2-Dimethylbenzene

PRODUCT USE: Solvent

MANUFACTURER: Honeywell, Burdick & Jackson
1953 South Harvey Street
Muskegon, MI 49442

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-368-4890

IN CASE OF EMERGENCY CALL:
(24 Hours/Day, 7 Days/Week)
1-800-707-4555 (or Chemtrec 1-800-424-9300

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT %
o-Xylene	95-47-6	100

Trace impurities and additional material names not listed above may also appear in Section 15 towards the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Flammable liquid and vapor. Irritating to the eyes, skin and mucous membranes. May also cause headache, fatigue, vomiting, dizziness and central nervous system depression.

POTENTIAL HEALTH HAZARDS

SKIN: Irritant. Chronic exposure can cause dermatitis through defatting of tissue. Rash or blisters may occur.

EYES: Irritant. Symptoms may include tearing, blurring, and sensitivity to light.

INHALATION: Can cause central nervous system depression. Irritation including nausea, headache, dizziness, drowsiness, loss of coordination, fatigue, lung congestion and lowered body temperature.

INGESTION: Can cause digestive disorders, bloody vomit, intoxication, liver and kidney damage.

DELAYED EFFECTS: Prolonged or repeated exposure can cause liver and kidney damage and coma. Can be

MSDS Number: BAJ1070
Current Issue Date: February, 2004

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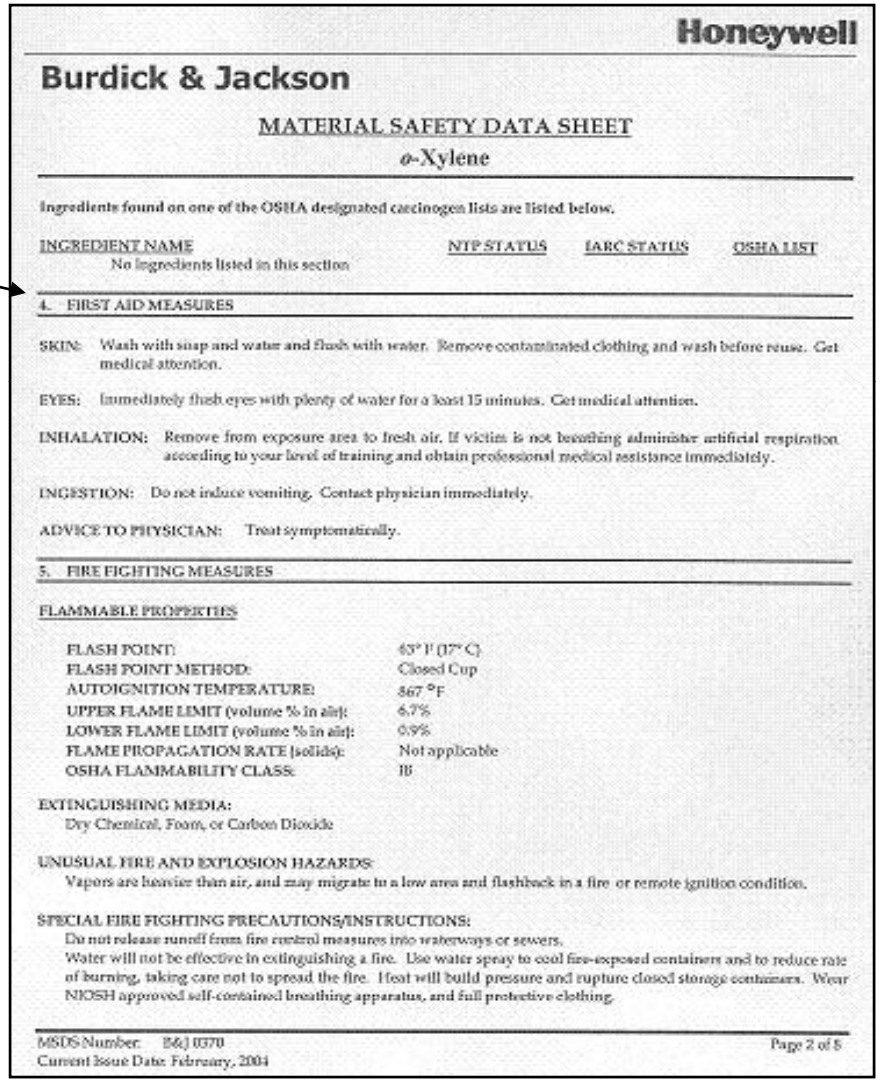
How to Read a MSDS (cont$^{nd.}$)

Section 4: First Aid Measures. Includes emergency and first aid procedures.



Honeywell

Burdick & Jackson

MATERIAL SAFETY DATA SHEET

o-Xylene

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

INGREDIENT NAME	NTP STATUS	IARC STATUS	OSHA LIST
No ingredients listed in this section			

4. FIRST AID MEASURES

SKIN: Wash with soap and water and flush with water. Remove contaminated clothing and wash before reuse. Get medical attention.

EYES: Immediately flush eyes with plenty of water for a least 15 minutes. Get medical attention.

INHALATION: Remove from exposure area to fresh air. If victim is not breathing administer artificial respiration according to your level of training and obtain professional medical assistance immediately.

INGESTION: Do not induce vomiting. Contact physician immediately.

ADVICE TO PHYSICIAN: Treat symptomatically.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT:	63° F (17° C)
FLASH POINT METHOD:	Closed Cup
AUTOIGNITION TEMPERATURE:	867 °F
UPPER FLAME LIMIT (volume % in air):	6.7%
LOWER FLAME LIMIT (volume % in air):	0.9%
FLAME PROPAGATION RATE (solids):	Not applicable
OSHA FLAMMABILITY CLASS:	IB

EXTINGUISHING MEDIA:
Dry Chemical, Foam, or Carbon Dioxide

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Vapors are heavier than air, and may migrate to a low area and flashback in a fire or remote ignition condition.

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:
Do not release runoff from fire control measures into waterways or sewers.
Water will not be effective in extinguishing a fire. Use water spray to cool fire-exposed containers and to reduce rate of burning, taking care not to spread the fire. Heat will build pressure and rupture closed storage containers. Wear NIOSH approved self-contained breathing apparatus, and full protective clothing.

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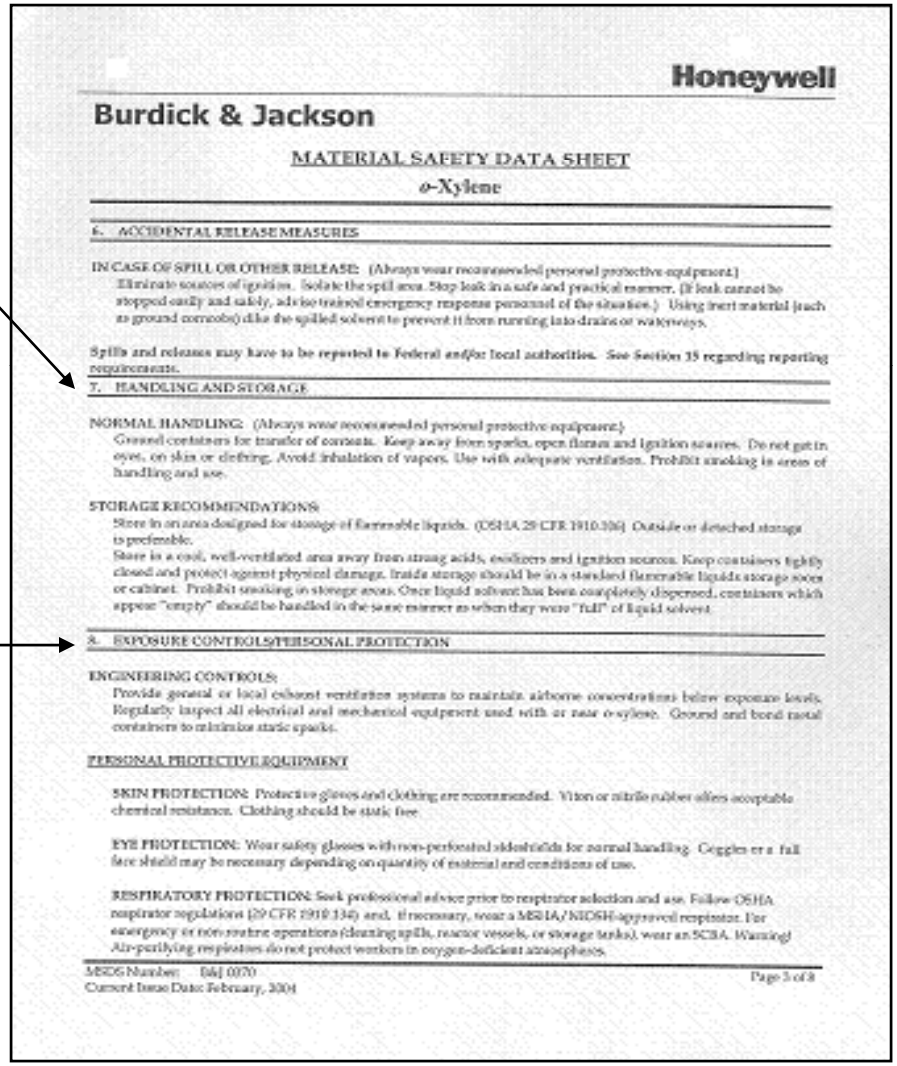
How to Read a MSDS (cont$^{nd.}$)

Section 7: Handling and Storage. Explains how to properly handle and store the chemical.

Section 8: Exposure Controls, Personal Protection. Describes how to maintain proper ventilation and recommends appropriate personal protective equipment, such as respirators, safety eye gear, gloves, and other protective clothing.



Honeywell

Burdick & Jackson

MATERIAL SAFETY DATA SHEET

o-Xylene

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: (Always wear recommended personal protective equipment.)
Eliminate sources of ignition. Isolate the spill area. Stop leak in a safe and practical manner. (If leak cannot be stopped easily and safely, advise trained emergency response personnel of the situation.) Using inert material (such as ground corncobs) dike the spilled solvent to prevent it from running into drains or waterways.

Spills and releases may have to be reported to Federal *and/or* local authorities. *See Section 15 regarding reporting requirements.*

7. HANDLING AND STORAGE

NORMAL HANDLING: (Always wear recommended personal protective equipment.)
Ground containers for transfer of contents. Keep away from sparks, open flames and ignition sources. Do not get in eyes, on skin or clothing. Avoid inhalation of vapors. Use with adequate ventilation. Prohibit smoking in areas of handling and use.

STORAGE RECOMMENDATIONS:
Store in an area designed for storage of flammable liquids. (OSHA 29 CFR 1910.106) Outside or detached storage is preferable.
Store in a cool, well-ventilated area away from strong acids, oxidizers and ignition sources. Keep containers tightly closed and protect against physical damage. Inside storage should be in a standard flammable liquids storage room or cabinet. Prohibit smoking in storage areas. Once liquid solvent has been completely dispensed, containers which appear "empty" should be handled in the same manner as when they were "full" of liquid solvent.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:
Provide general or local exhaust ventilation systems to maintain airborne concentrations below exposure levels. Regularly inspect all electrical and mechanical equipment used with or near *o*-xylene. Ground and bond metal containers to minimize static sparks.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION: Protective gloves and clothing are recommended. Viton or nitrile rubber offers acceptable chemical resistance. Clothing should be static free.

EYE PROTECTION: Wear safety glasses with non-perforated sideshields for normal handling. Goggles or a full face shield may be necessary depending on quantity of material and conditions of use.

RESPIRATORY PROTECTION: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For emergency or non-routine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

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What is wrong with this picture?

Hockey players wear protective gear – so can you!

DfE Best Practices
Self Evaluation Checklist

Self Evaluation Checklist - Purpose

- Provide shop owners a tool to:
  - Assess protection of workers and community
  - Focus improvement efforts
  - Ensure ongoing implementation of best practices

Self Evaluation Checklist - Use

- Checklist assesses key refinish activities:
  - Surface preparation
  - Paint mixing
  - Spray painting
  - Spray gun cleaning
  - Health and safety management

Evaluators Name: _____

Shop/School Name: _____

SELF-EVALUATION CHECKLIST

		Baseline Evaluation Date:		Follow-Up Evaluation Date:	
		Check Yes or No	Points	Check Yes or No	Points
I.	**SURFACE PREPARATION**				
	Sanding				
1a	Does the shop consistently use vacuum sanding, a ventilated prep deck, and/or wet sanding methods?	☐ Yes=3 ☐ No=0		☐ Yes=3 ☐ No=0	
1b	If you answered "No" to question 1a above -- Do workers performing dry sanding tasks consistently use a half-mask air purifying respirator (APR) with an appropriate particulate filter (N95 or better)? *The best protection to the person performing sanding and to all others in the workplace is provided by using one of the methods listed in item 1.a above. If such methods are not used, the person performing dry sanding tasks should use appropriate respiratory protection to prevent inhalation of hazardous dusts.*	☐ Yes=1 ☐ No=0		☐ Yes=1 ☐ No=0	
2	Are vacuum sanders and/or prep decks well maintained? *Well maintained equipment will ensure proper capture of sanding dusts.*	☐ Yes=1 ☐ No=0		☐ Yes=1 ☐ No=0	
3	Workers wear nitrile (or other impermeable gloves) when performing wet sanding tasks? *Many abrasive compounds used for wet sanding are potential skin irritants. Refer to the product's MSDS for more information on hazards and required protective equipment.*	☐ Yes=1 ☐ No=0		☐ Yes=1 ☐ No=0	

Best Practices - Benefits

EVALUATION TABLE

POINTS	EVALUATION OF OVERALL TOTAL POINTS
0-20	The shop has taken little if any positive steps to minimize emissions of isocyanates and other hazardous materials (or to protect workers and the surrounding community from such emissions) generated during refinishing tasks.
21-60	The shop has taken some positive steps to minimize emissions of isocyanates and other hazardous materials (or to protect workers and the surrounding community from such emissions) generated during refinishing tasks but much work is still needed.
61-85	While the basics are in place, some critical best practices still need work to ensure effective emission reduction and worker and community protection.
86-107	Congratulations. It appears that the shop has implemented most if not all of the key best practices. Keep up the good work and continue efforts to implement all best practices to ensure a healthy and safe environment for your workers and the surrounding community.

On-line Resources

- DfE Auto Refinish Project
  http://www.epa.gov/dfe/pubs/projects/auto
- Virtual Auto Body Shop
  http://www.ccar-greenlink.org/cshops
- STAR® (Spray Technique & Research)
  http://www.iwrc.org/STAR/STARschools.htm
- OSHA Auto Body Repair and Refinishing
  http://www.osha-slc.gov/SLTC/autobody
- NIOSH Alert on Diisocyanates
  http://www.cdc.gov/niosh/asthma.html

Contacts

DfE Auto Refinish Project

www.epa.gov/dfe/pubs/projects/auto

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