COMPLIANCE ASSISTANCE PROGRAM

SPOKANE REGIONAL CLEAN AIR AGENCY with

DEPARTMENT OF ECOLOGY
State of Washington

Surface Coating of Metal, Plastic and Wood

A Guide To Reducing Air Pollution & Saving Money

What's Inside

- What Businesses are Affected by the Surface Coating Regulations
- How to Avoid Penalties
- What you Need to Know About VOC
- Self-Inspection Checklist

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The information in this guide covers the basic requirements you need to know and will help you prepare for periodic air pollution control inspections.

Sample self-inspection checklists are provided at the end of this booklet, but you may want to come up with a specific checklist for your facility.

Identify any potential problems and take action. Replace or repair defective components immediately. Do your part to help yourself, your customers, and the environment.

Para asistencia en español: preguntas@ecy.wa.gov

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DEPARTMENT OF ECOLOGY
State of Washington

Spokane Regional Clean Air Agency
working with you for clean air

Why Did We Produce This Booklet?

Spokane Regional Clean Air Agency (Spokane Clean Air) and Washington Department of Ecology (Ecology) are committed to helping local businesses understand air quality regulations and thereby stay in compliance. The intent of this booklet is to help you understand the requirements as they apply to coating of metal, plastic, wood and auto bodies. (See Spokane Clean Air Regulation I, Section 6.13.)

The following information will help you understand how you can improve your working conditions, keep your customers and neighbors satisfied, comply with the law, avoid penalties, and reduce air pollution.

As many businesses have discovered, self-inspections can even help you save money.

At the back of this booklet is a form that will help you conduct a self-inspection and better understand if your operations are in compliance with the air quality regulations.

Spokane Regional Clean Air Agency

How Does The Surface Coating Regulation Apply To Me?

Surface coating regulation applies to all commercial and industrial facilities that use surface coatings, solvents, and other agents. It does not apply if you are painting for personal noncommercial purposes and using less than five gallons of coatings per year, or if you are painting architectural surfaces, like a home or other stationary structures.

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Why Should My Business Try To Reduce Air Pollution?

Emissions from surface coating operations include VOCs (volatile organic compounds), toxic air pollutants and particulate matter. These emissions come primarily from solvents evaporating from paint, overspray, cleanup and storage. In the presence of sunlight, VOCs participate in a complex reaction with oxides of nitrogen in the air to produce ground-level ozone. Ozone is a strong irritant that attacks the lungs, makes breathing difficult, may cause your eyes to water, and is the major ingredient in smog. Prolonged exposure can cause permanent lung damage.

The surface coating regulations are designed to reduce particulate emissions, reduce public exposure to toxics, prevent ground-level ozone formation and encourage pollution prevention. In addition, reducing the amount of VOC in coatings can reduce the exposure of your workers to organic solvents and decrease your waste disposal costs.

The surface coating regulations reduce the amount of particulates and VOCs that are emitted into our air, as shown in the example below.

Example
Shop A and Shop B both use the same type of paint. Both shops need to apply 150 gallons of paint to their products. Shop A uses conventional paint guns and no filters. Shop B uses High Volume Low Pressure (HVLP) paint guns and paint arrestor filters. The amount of paint used by each shop to apply 150 gallons to the parts and the subsequent emissions are given in the following table:

	Shop A	**Shop B**
Paint Gun Type	conventional paint guns	HVLP paint guns
Transfer Efficiency	35%	65%
Filtration	no filters used	arrestor filters used
Paint Applied Per Year	150 gal/year	150 gal/year
Paint Used Per Year	**429 gal/year**	**231 gal/year**
VOC Emissions	**2,314 lbs VOC/year**	**1,246 lbs VOC/year**
Particulate Emissions	**1,543 lbs Part./year**	**25 lbs Part./year**

As you can see, the use of HVLP guns and filters significantly reduces emissions. Shop B emits 46% less VOCs and 98% less particulate than Shop A. In addition, Shop A had to purchase almost 200 more gallons than Shop B to apply the same amount of paint to the parts. Increased efficiency reduces the amount of paint your company has to buy and may decrease your hazardous waste disposal costs.

What Businesses are Affected by the Surface Coating Regulations?

Washington has hundreds of registered businesses that apply surface coating to metal, plastic, wood, and auto bodies. They include: ***Auto Body Shops, Metal Fabricators, Wood Working Shops, Boat Building Facilities, Plastic Parts & Composite Structure Manufacturers.***

How Do I Comply with Regulations and Avoid Penalties?

Surface coating operations must follow Washington's Notice of Construction (NOC) and Registration requirements. For more information on these requirements, visit **www.spokanecleanair.org** if your business is in Spokane County, or visist **www.ecology.wa.gov/air** if your business is in other counties in Washington.

Remember, your entire facility is subject to the surface coating requirements. ***There are a few basic things you need to know and do to help your company stay in compliance and protect air quality:***

- Keep accurate records of coating and clean-up materials purchased, used and disposed of during the last 5 years
- Store coating products and waste materials in closed containers
- Clean up spills promptly
- Enclose and control emissions with the use of an approved booth and control system
- Use acceptable application methods: HVLP, Low Volume Low Pressure (LVLP), electrostatic, brush coat, dip coat, flow coat, roll coat, or pre-package aerosol (airless and air assisted airless may be used in some situations)
- Use an enclosed gun cleaner (only if your permit requires it).
- Make sure light duty vehicle coatings meet VOC content limits
- Make sure your stack allows for upward flow with no obstructive caps and must vent vertically.

  *See appendix for more information.
- Maintain your equipment
- Keep a log of paint booth maintenance activity and filter changes
- Increase your coating transfer efficiency by training personnel in the proper use of equipment
- Use filters designed for use in spray paint operations
- Don't use coatings containing lead and chromates greater than 0.1% by weight, unless you obtain an exemption from Spokane Clean Air or Ecology.

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What Do We Look for During a Facility Inspection?

An air quality inspector may routinely inspect your facility. Your coating operations will be examined to verify compliance with surface coating rules.

The inspector may review:

- NOC conditions of approval (if applicable)
- Types of coatings used and products coated
- Types of solvents used to thin coatings
- Coating and solvent purchase records
- VOC content (for auto body coating) and Material Safety Data Sheets (MSDS)
- Maintenance logs
- Waste disposal manifests

The inspector may examine:

- Surface preparation techniques and controls
- Application equipment operation
- Spray booth condition
- Type of filtration and condition of filtration system
- Ducting behind filters
- Clean-up procedures
- Coatings and solvents storage
- Waste storage
- Pressure drop gauges (when present)
- Stack height and rain guard

How Do I Make Sure My Coatings Comply with Regulations?

Many coatings are available to meet the specific requirements. Coating technology continues to develop and new materials are being incorporated into innovative coating systems to meet industry's changing needs. Application equipment is also being designed and improved to apply the new coatings at greater efficiencies. It's a good idea to maintain contact with several manufacturers of coatings and application equipment to make sure you have a system that works best for your operation. Cost savings for you may include improved coating quality, lower quantities of coatings purchased and applied, and reduced waste disposal costs. In addition, Washington's air quality benefits from reduced VOC and toxic emissions.

What Do I Need to Know About VOC Content?

Coatings consist of solids (resin, pigments, extenders, additives) and solvents. Solvents lower the viscosity (reduce or thin), and act as the carrier for the solids. Solvents also are used to dissolve the solid resin. Solvents evaporate from the coating before, during and after application. Solvents include VOCs, water, and exempt solvents. VOC content means pounds of VOCs per gallon of coating (lb/gal) or grams of VOCs per liter of coating (G/L), minus water and exempt solvents (exempt solvents do not contain volatile organic compounds).

The VOC concentration does not change if you increase the volume of mixed paint used, however, the VOC concentration does increase when adding VOC solvents (most thinners and reducers).

Manufacturers are currently being required by federal regulations to formulate paint to certain VOC specifications, that when used, according to the manufacturer's recommendations, will meet VOC content limits. The VOC content is generally stated on the label or on the manufacturer's paint specification sheet*. ***If you coat light duty vehicles, VOC compliant coatings must be used.***

*See appendix for more information.

What Types of Coatings Are Available?

Traditionally, metal, plastic, and wood coatings contained solvents with high levels of VOCs. Today there are many kinds of alternatives available that have low VOCs and reduce VOC and toxic air emissions. Some of the preferred types of coatings include:

Water Borne - Water is the major solvent and includes water reducible and emulsions. These coatings usually include VOCs as co-solvents.

High Solids - Coatings that contain greater than normal resin and pigment (70 - 80% by volume).

UV Curable Coating - Liquid resin and pigment which uses UV light to cure the coating.

Powder - Dry, finely-ground coating which is usually sprayed dry on an electrically charged surface and is later heated to its melting point so that the powder can flow together (3% VOCs by volume).

Exempt Solvent Based - Coatings that contain exempt solvents, primarily 1,1,1 TCA. These coatings usually include VOC as stabilizers and co-solvents.

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Electrodeposition - Dip coating process where water borne coatings are electrically "plated-out."

Autodeposition - Dip coat plating process without electrical charge.

Catalyzed Coatings - Two or three component coatings which are mixed together prior to application.

Other coating systems may be available and all systems have advantages and disadvantages. Be sure to consider worker safety, respiratory protection, waste disposal, surface and equipment compatibility, fire requirements, odor releases, and emissions of potentially toxic materials, when deciding on a coating system. Remember, keep the solids content in mind when comparing the costs* of your coatings. Contact your suppliers for additional information.

*See appendix for more information.

What Transfer Methods Can I Use?

Regulations require that coatings and agents containing more than 2.1 lb/gal or 250 grams/liter VOC be applied using any of the following high transfer efficiency methods:

- High-Volume, Low-Pressure coating system
- Low-Volume, Low Pressure coating system
- Electrostatic application
- Flow coat application
- Dip coat application
- Brush coat application
- Pre-packaged aerosol can application
- Roll coat application
- Airless or air assisted airless under prescribed circumstances
- Other applications that have received prior written approval from Spokane Clean Air or Ecology
- Spraying techniques with transfer efficiencies of at least 65%

How Should I Maintain My Spray Booth Filters?

Spray booth filters prevent paint overspray from traveling up the exhaust vent. Filters help increase the life span of the exhaust fans, reduce fire hazard, and provide protection from the deposition of paint particles outside the building. It is important to maintain your booth to ensure that your operation does not cause a public nuisance and violate air quality regulations. Paint overspray can travel through ineffective filters and damage the finish of automobiles and structures near your operation. Always make sure that the filters are installed properly and cover all openings. The filter media you use must be designed for your type of spray operations. If there is any paint residue/particulate behind the filters, it typically indicates a problem exists with the filtration system (e.g., not using proper type of filter media, filters don't fit/seal well, filters are not always being used, filters are torn, etc.)

Check Your Spray Booth Filter Pressure

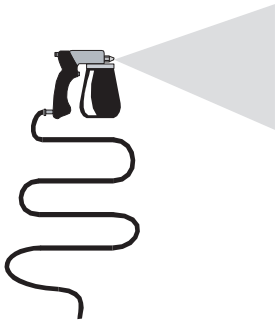
A pressure drop gauge (manometer or magnehelic) may be used to determine the pressure drop across the spray booth filters. As the filter pores become clogged, the pressure drop increases. To be effective, filters should be replaced according to manufacturers recommendations. Check your pressure gauge frequently for accuracy and, if it is a manometer, maintain its fluid level. The pressure drop should read zero when the exhaust fan is off.

Keep Your Curtain Wet

Waterwash booths should provide a continuous sheet of water down the face of the rear booth panel. The water sheeting collects the overspray from the painting operation and the particulates can be skimmed from the surface of the water for disposal. If the booth does not provide a continuous sheet of water, i.e. if dry spots appear, the water spray lines should be checked for clogged openings. Remove the booth from service and repair the water lines immediately.

Be sure to check and maintain the chemicals and additives in the water. Be aware that the City and County wastewater utilities and Ecology may have additional requirements. These agencies are listed in the resource section at the end of this guide. Never discharge your wastewater to the ground or storm drain system.

What About Transfer Efficiency and Compliant Application Methods?



Transfer efficiency is the percentage of paint solids deposited on the surface of your product. The cost savings in paint consumption when using high transfer efficiency guns is significant. If you achieve 30% transfer efficiency, then 30% of the paint solids sprayed have adhered to the product, and 70% of the paint solids are on your floor, booth walls, and exhaust filters. ***You can get more paint to stay on the product if you use application methods with transfer efficiencies in excess of 65%, and you buy less paint.***

Wasting Paint is a Waste of Money

High transfer efficiency saves paint and decreases emissions, thus lowering your costs. High transfer efficiency decreases your booth filter purchases, decreases your booth cleaning expenses, and may decrease your waste disposal costs. Train your painters to maximize their efficiency. Consider racking parts to make overspray land on a part. Make sure automatic spray lines spray the parts and not empty hooks. Spray corners of parts first so overspray hits uncoated areas of the part.

Maintain and Operate Your Equipment Properly

Transfer efficiency is dependent upon many factors which include proper operation and maintenance of the coating equipment, size and shape of the part, type of coating, ambient temperature, humidity, and operator training and error. You can take these steps to increase your efficiency.

- Use properly designed equipment
- Eliminate cross drafts
- Reduce air pressure in gun
- Allow dipped parts to drain
- Only spray the part
- For electrostatic painting
  - turn on power to electrostatic
  - keep a good clean ground
  - hook up the grounding strap

Contact your equipment supplier for more information on how to improve your transfer efficiency. Even if you are not required to increase your transfer efficiency, you should check into it – ***it can save you money.***

How Should I Store My Solvents and Coatings?

Keep all containers of coatings and solvents closed. Cans and drums should be equipped with tight fitting lids and should remain closed between uses to prevent evaporation. Large drums should have screw caps to cover the bung holes and should be opened only to empty or fill the drum. Use a pump or funnel when filling and make sure to close the drum completely when you are finished. Look for the new funnels that screw into the bung of drums and have a lid that clamps down on top of the funnel for a tight seal.

Store waste solvents in closed containers with tight fitting lids. Make sure the bung holes in 55 gallon waste solvent drums are closed. All solvent laden rags and cloths including those used to clean parts and spray equipment should be stored in closed fireproof containers. Store and dispose of materials in accordance with local fire department, solid waste, and State Department of Ecology requirements.

How Should I Clean My Surface Coating Equipment?

VOCs from your facility can be reduced significantly by cleaning your spray guns and other equipment properly. Never clean your lines by spraying solvents into the air or into the filters. Purging your lines in this manner wastes your cleanup solvent and is a violation of air quality regulations. Always direct the clean-up solvents, using minimal pressure, into containers to prevent evaporation.

When cleaning paint guns, remove atomization tips, soak and/or use a brush to clean the tip, then flush solvent through the gun (without the tip) into a container which is immediately sealed. Soak spray guns in closed containers. Consider purchasing an enclosed gun washer – they are a faster, cleaner way to remove paint from guns with less VOC emissions. Cleaning processes are continually improving, saving businesses money in solvent costs and reducing air emissions. Here are some ideas:

- Designate guns for specific colors or types of paint
- Clean equipment immediately after use, first with dirty solvent then a final cleaning with virgin solvent
- Use disposable paint cup liners
- Recycle or distill waste solvent
- Avoid the use of VOCs for clean-up whenever possible. Alternatives include water, semi-water, citrus or biological solvent-based cleaners

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Are There New Surface Preparation Techniques I Should Know About?

Instead of using solvents, investigate the use of abrasives, sanding, water with surfactants, alkaline washes, or acid etches for surface preparation in your operation. Many businesses have found that switching from solvent cleaners to other surface preparation methods can save money and reduce disposal costs. See the back of this guide for the information sheet, "Understanding Solvent Cleaning and Air Quality."

What Kind of Records and Logs Should I Maintain?

Keep Current Logs
Keep detailed records of the coatings applied at your facility. Monthly logs should detail the products purchased, including the name and number of the product, and the amount of product purchased, with the appropriate unit indicated (i.e., gallon, quart, pint). Remember that air quality inspectors look for accurate records.

One proven method of recordkeeping involves the use of job tickets and a summary log. Many facilities instruct the operator to record coating information for each job on a production ticket at the booth. The job tickets are then summarized nightly by the supervisor. Air quality rules require that the coating records be retained by the operator for two years. Job tickets and coating logs should be stored for this purpose.

Know What Your Records Say
Accurate recordkeeping helps to ensure that you operate in daily compliance. Daily recordkeeping has several other advantages as well. Your records tell you how much paint you use each day. You will have an accurate record of production expenses which can enable you to cut costs.

Your approved Notice of Construction may include a limitation on annual coating usage. Do not paint more than you are allowed. Request a revision to your NOC by contacting Spokane Clean Air or Ecology, or modify your production schedule to avoid penalties. Be careful with multiple shifts.

What If A Specification Requires A Different VOC Content?

Never accept a contract which requires that you use coatings which do not comply with the VOC, lead and hexavalent chromium requirements. You can be held liable for each day that you apply non-compliant coatings. When you see that a contract requires you to use an unapproved coating, ask the company to change the terms of the contract, or contact Spokane Clean Air or Ecology to find out if an exemption for that material can be obtained.

Where Should I Display My NOC Approval?

Place a copy of your NOC Approval, including the specific conditions which must be met by the operator, in a visible place whenever possible. Make sure that you follow the conditions outlined on your Approval. It is important that the operators understand all of the requirements. Many operators provide plastic covers for the Approvals to protect them from damage, and incorporate the air quality conditions required of the facility into their employee training.

What Happens If I Violate Air Quality Regulations?

Violating the law can be costly. Penalties for violating air pollution regulations can be up to $10,000 per day. Remember, the benefits of reducing your VOCs and particulate emissions are not simply avoiding penalties...but also providing a safer work place, a healthier environment and greater profits. Experience tells us that the best way to comply with air pollution regulations is to find out what is required and comply with those requirements.

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How Will A Self-Inspection Checklist Help Me?

A self-inspection checklist is a good way to help ensure that your facility is in compliance. The information in this guide covers the basic requirements you need to know, and will help you prepare for air pollution control inspections. A sample self-inspection checklist is provided at the end of this booklet. But, you may want to come up with a specific checklist for your facility.

Identify any potential problems and take action. Make sure everyone mixing and applying your coatings, or cleaning up after your coating operation, understands and follows all of the requirements. The best way to comply is to know the requirements, keep up with technology, and inspect your operation daily.

Do your part to help yourself, your customers and the environment.

What Other Agencies Regulate Surface Coating?

Some of the other agencies that regulate surface coating include:

- **City of Spokane Fire Department**, 509-625-7000
- **Spokane County Fire Districts**, check the phone book for the district in your area
- **Spokane County Division of Building and Planning**, 509-477-3675
- **Washington Department of Labor and Industries**, 509-324-2600
- **Washington Department of Ecology**, **Eastern Region 509-329-3400**
- **Washington Department of Ecology, Central Region 509-575-2490**
- **Washington Department of Ecology, NW Region 425-649-7000**

Your operations are likely regulated by additional agencies. Refer to Spokane Clean Air's information sheet – Common Environmental Permits Required in Spokane County, available at **www.spokanecleanair.org** or call 509-477-4727.

Pollution Prevention Resources

Pollution Prevention can save time and money while protecting the environment.

Reduced operating costs - save money in product and labor costs.

Reduced compliance costs - reduce air pollution emissions, which may reduce registration fees.

Reduced liability - removing hazardous products can reduce employee and community liability.

Increased productivity - improve the efficiency of the manufacturing process, increasing worker productivity.

Improved company image - show you care about your workers, the community and the environment by implementing programs to reduce air pollution from your facility.

Spokane Clean Air offers a free Pollution Prevention (P2) consultation to assist businesses in meeting and exceeding air quality regulations. Sign up for a P2 consultation by calling (509) 477-4727.

There are many additional resources available to help businesses research and implement pollution prevention practices.

- **GreenLink**
  www.ccar-greenlink.org

- **Environmental Protection Agency Automobile Refinish Coatings**
  www.epa.gov/stationary-sources-air-pollution/automobile-refinish-coatings-national-volatile-organic-compound

- **National Compliance Assistance Centers**
  www.complianceassistance.net

- **Pacific NW Pollution Prevention Resource Center**
  www.pprc.org

- **Paints & Coatings Resource Center**
  www.paintcenter.org

- **Spokane Regional Clean Air Agency, Pollution Prevention**
  www.spokanecleanair.org/documents/business/CAP-P2-Program.pdf

- **WA Department of Ecology, Pollution Prevention**
  www.ecology.wa.gov/PPA

The self-inspection checklist is provided by the Ecology Department to help businesses better understand air quality compliance requirements. However, the checklist is generic and each business may need to expand or adjust the checklist based upon individual operations. Businesses should not assume that the checklist is exhaustive, and should not rely on the checklist for compliance. It is the business's responsibility to fully comply with all environmental laws. If there is a conflict between the checklist and Ecology Department regulations, the regulations will govern. Please remember that periodic completion of the checklist is not a substitute for ongoing compliance.

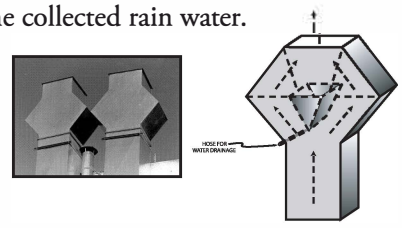
Inspection Questions.	**Yes**	**No**	**N/A**
1. Legible copies of the permit displayed onsite and available to employees?			
2. Legible copies of O&M manuals displayed onsite and available to employees?			
3. SDS sheets available for products used at the facility?			
4. Methylene chloride paint stripper used? If Yes, quantities used recorded?			
5. Abrasive blasting conducted at the facility? [Exempt if done in an enclosed space]			
6. Date paint booths installed? 1) 2) 3)			
7. Exhaust filter capture efficiencies (98% required)?			
8. Fuel-fired bake booth and fuel type and BTU/hr rate? Fuel Type_____ BTU/hr rate_____			
9. Exhaust filter changes being documented?			
10. Opacity observed every time exhaust filters are changed?			
11. Surface coating conducted in enclosed negative pressure spray booth?			
12. Paint booth have manometer/Magnehelic gauge?			
13. Manual application of all pretreatment washes conducted in the spray booth with the exhaust blower operating?			
14. Sanding and grinding done in enclosed building that allows only incidental amounts of sanding/grinding particulate matter to escape to the outside air?			
15. Spray guns are HVLP or equivalent transfer efficiency?			
16. Spray gun cleaning done in enclosed apparatus?			
17. Are VOC containing materials stored in closed containers when not in use?			
18. Are low VOC containing materials or water based coatings used?			
19. Visible emissions from the paint booth exhaust stacks while booth is in use?			
20. Release height on paint booth exhaust stacks minimum 3.5 feet above the roofline?			
21. Exhaust stacks vent vertically, no restricting exhaust cap, and minimal bend, obstructions, and building interference?			

Appendix - Stack & Rain Guard Requirements A

Air quality regulation requires that emissions from air pollution sources, including surface coating operations, exhaust through an unobstructed, vertical stack. The top of the stack must be 6 feet above the penetration point of the roof. The purpose of these requirements is to allow for upward dispersion of pollutants, thereby reducing impacts and odor nuisances. Stacks installed with rain guards must meet the **unobstructed, vertical flow requirements**.

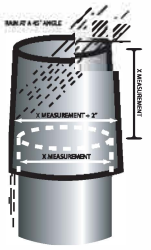
Approved Rain Guards - These rain guard designs have been approved by Spokane Clean Air. Other designs may be submitted to Spokane Clean Air or Ecology for approval prior to construction and installation.

Hexagonal Stack - This design diverts air around an internal wedge used to catch rain. A hose is connected to the bottom of the wedge which drains the collected rain water.



Hinged Stack - A hinged flapper damper opens when the paint booth is running and closes when fan is turned off. A booster fan may need to be installed to help push open the flaps.

Stack-in-a-Stack - This design is based on the principle that rain falls at an angle. The inner stack is surrounded by an outer stack with space between the two. Rain runs down the inside wall of the outer stack, instead of down the inside wall of the inner stack and into the paint booth.



Inverted Cone Stack - Grating or brackets support the cone which is suspended above the stack opening.

Where Can I Get Stack and Rain Guards?
Some companies specializing in sheet metal ducting also make stacks and rain guards. These companies can be found in the phone book, under "Sheet Metal Work." For information, call Spokane Clean Air at 509-477-4727 or Ecology at 509-329-3400.

Two Examples of Unapproved Rain Guard & Stack - These are not acceptable:

"Goose Neck" Stack Not Acceptable
Does not allow for an unobstructed, upward, vertical flow.

Unacceptable Cap
Stacks must provide for unobstructed, upward, vertical flow. This Cap does not allow this to occur.

B Appendix - Calculating VOC Emissions

Volatile Organic Compounds (VOCs) are found in many products used throughout the manufacturing process. VOCs evaporate readily into the atmosphere where reactions with sunlight produce ground-level ozone. There are many individual chemicals that are considered a VOC. The most common VOCs include xylene, toluene, MEK, and MIBK. Types of common products that contain VOCs include solvents, cleaners, degreasers, resins, glues, inks, coating, paints and thinners. Fortunately, most Materials Safety Data Sheets (MSDS) contain VOC content information already calculated for you. Many paint and solvent suppliers and distributors have also produced special Air Quality Data Sheets (AQDS) or VOC Emissions Data Sheets to assist their customers in determining their VOC emissions.

Step 1: Each product will have different emissions, depending on:

1. The VOC content of the product (in pounds of VOC per gallon of product) can be determined in the following ways:
   - Directly identified on an AQDS, a VOC Emissions Data Sheet, or a MSDS, or
   - Derived using the percent of volatile compounds, less the water, and the weight of the product.
2. The weight of the product (in pounds per gallon of product) can be determined in the following ways:
   - Directly identified on an AQDS, a VOC Emissions Data Sheet, or a MSDS, or
   - Derived using the specific gravity of the product.
3. The annual use of the product (in gallons/year).

Step 2: Emissions Calculation

If the VOC emissions are not provided in a MSDS or AQDS, use the Emissions Calculation Sheet below for each VOC-containing product used. All the information needed to calculate the VOC emissions from any VOC-containing product can be found in the MSDS. Ask your supplier, distributor or manufacturer for more information.

Emissions Calculation Sheet

Name of Product: _____

1. Enter the VOC content of the product: _____ lb VOC/gal
2. If the VOC content is not given, then:
   a. Enter the % volatiles of the product: _____ %
   b. Enter the weight of the product: _____ lb/gal
   c. Multiply line 2a by line 2b and enter: _____ lb VOC/gal
3. If the weight of the product is not given, then:
   a. Enter specific gravity of the product: _____
   b. Multiply line 3a by 8.34: _____ lb/gal
   c. Enter in line 2b: _____
4. Enter the amount of the product used last year: _____ gallons/yr
5. Multiply line 1 or line 2c by line 4 and enter: _____ lbs VOC/yr
6. Divide line 5 by 2,000 and enter: _____ tons VOC/yr

Line 6 is the estimated tons of VOC emitted per year from the application of this VOC-containing product.

Calculations courtesy of Oregon Department of Environmental Quality

Appendix - Calculating True Cost of Coatings C

If you simply look at price per gallon, alternative coatings often seem more expensive. Price per gallon, however, does not tell the whole story. You can only determine true costs by calculating how much the coating costs per unit of painted product. Once this calculation is completed, you can make a more informed decision on whether to purchases a substitute coating product.

Step 1: Figure Cost of Paint Solids

Conventional solvent-based liquid paints include both volatile and solid components. When the paint is applied, the volatile components evaporate and the solids are left behind on the surface of your product. The cost of that solid fraction is what you need to figure to accurately compare the costs of coating products. The cost of the solid fraction can be calculated from information provided in the product's Material Safety Data Sheet (MSDS) or Product Data Sheet (PDS), which are available from the manufacturers. The paint's total per-gallon cost is divided by the solids percentage to obtain the cost per gallon of solids.

Example: If a paint product costs $15 per gallon and contains 33% solids, then you would divide 15 by 0.33. So, 15 / 0.33 = $45.45, the cost per gallon of paint solids.

Step 2: Figure Ideal Paint Cost per Square Foot

If a desired thickness is known, this cost can be further refined into a cost per unit of painted surface area using the following formula: (Cost of paint solids per gallon) X (film thickness in millimeters) X (0.0006233)

Example: ($45.45 per gallon of paint solids) X (2 mils finished film thickness) X (0.0006233 conversion factor) = 5.7 cents per square foot, assuming an ideal 100% transfer efficiency.

Step 3: Figure Actual Paint Cost per Square Foot

100% transfer efficiency is almost never achieved when applying liquid coatings with spray equipment. To calculate a more accurate cost of using a liquid coating, the transfer efficiency of the application equipment and paint product must be considered.

In most spray painting operations, only a portion of the product that is sprayed actually reaches the surface to be coated. The remainder, or overspray, is collected in the paint booth exhaust filter or settled to the floor of the paint area. The amount of paint reaching the product versus the total amount of paint sprayed is referred to as the transfer efficiency. To calculate the actual costs of paint per square foot of applied finish, the estimated transfer efficiency of the paint operation must be factored into the cost formula as follows:

> Ideal (100% transfer efficiency) paint cost per square foot divided by transfer efficiency percentage = actual paint cost per square foot.

Example: A paint operation has an estimated transfer efficiency of 50%. Take the 5.7 cent calculated for 100% transfer efficiency and divide by 0.50 to determine actual coating cost. (5.7 cents per square foot) / (0.50 transfer efficiency) = 11.4 cents per square foot.

Step 4: Figure Total Cost of Painting Manufactured Product

Now that a cost estimate per square foot has been determined, you can apply this figure an estimated cost per painted part.

Example: A flat panel part has an area of 10 square feet. Multiply your cost per square foot times the square footage of the part. (11.4 cents per square foot) X (10 square feet) = $1.14 per part. (Note: For parts that are oddly configured, estimate square footage.)

Calculations courtesy of Pollution Prevention Resources Council

COMPLIANCE ASSISTANCE PROGRAM Info

Solvent Cleaning & Air Quality

Solvent cleaning (commonly called degreasing) is a process using non-aqueous solvents to clean and remove soils from various surfaces. Solvent cleaning is common in the electronics, surface coating and automotive sectors.

If you own/operate any size solvent dip tank, parts washer, vapor or in-line cleaning machines that use solvents containing halogenated compounds, you are required to comply with National Emission Standards for Hazardous Air Pollutants (NESHAPs) for halogenated organic solvents, as mandated by the 1990 Clean Air Act. This means you must install required controls on equipment and adopt specific work practices or stop using the chemicals regulated under the rule.

What solvents are regulated?

The U.S. Environmental Protection Agency (EPA) adopted regulations (40 CFR Part 63 Subpart T) to control toxic air emissions from solvent cleaning equipment (including dip tanks, parts washers, vapor and in-line cleaning machines) that use any of these halogenated solvents:

- 1,1,1-trichloroethane
- carbon tetrachloride
- chloroform
- methylene chloride
- perchloroethylene
- trichloroethylene

The rule is a pollution prevention regulation that reduces solvent usage by requiring the use of good housekeeping practices and efficient, well-controlled cleaning equipment.

Why are these solvents regulated?

The solvents are known or suspected carcinogens and are widely used. Emissions from using these solvents present a threat to human health and the environment. Vapors from these solvents also contribute to ground-level ozone, a harmful air pollutant.

The Washington State Administrative Code, WAC 173-400-040(3)(a), requires reasonable precautions be taken to prevent the release of air contaminants from operations which are a source of fugitive emissions. Spokane Regional Clean Air Agency considers federal, state and local air pollution control requirements when registering, permitting and inspecting businesses.

The owner/operator of any type of solvent cleaning machine is required to collect all solvent waste and store it in a tightly closed container with no perceptible leaks.

Is my facility affected?

Owners/operators of **any** size facility with solvent cleaning equipment that holds, or has a solvent capacity greater than two gallons, that uses any of the six above named solvents are affected by this regulation. (Ask your vendor or refer to your Material Safety Data Sheets [MSDSs] to determine whether you use these chemicals in your cleaning process.) How you are affected depends on the type of equipment you have and the compliance option you choose.

Solvent cleaning machines are divided into two categories; batch cold cleaning equipment and batch vapor, in-line cold, in-line vapor cleaning equipment.

Batch Cold Cleaning Machines

The charts below summarize the rules for the most common solvent cleaning equipment in Spokane County - **batch cold cleaning equipment**. The parts are immersed into the solvent and when clean, parts are removed to dry.

Batch Cold Cleaning Machines

Compliance Options	Required Controls	
	Option 1	**Option 2**
Dip Tank (Immersion Batch Cold Cleaning Equipment) *Must choose one of two options listed to the right.*	1. Install a sealed cover 2. Achieve 1" water layer or ¼" wax layer 3. No work practices required	1. Install a sealed cover 2. Maintain a freeboard ratio of 0.75 or greater 3. Work practices required (see chart below)
Parts Washer (Remote Reservoir Batch Cold Cleaning Equipment)	1. Install a sealed cover 2. Work practices required (see below) 3. Install tight fitting cover over solvent sump	

Batch Cold Cleaning Machines
Required Work Practices

1. Store solvent waste in closed containers.
2. Flush parts in freeboard area.
3. Reduce pooling of solvent on and in parts.
4. Do not fill cleaning equipment above fill line.
5. Clean up solvent spills immediately.
6. Store wipe rags in closed metal containers.
7. Do not agitate solvent to the point of splashing.
8. When cover is open, minimize room drafts.
9. Do not clean absorbent materials.
10. Keep cover closed and turn off fans when not in use.

Batch Vapor, In-Line Cold and In-Line Vapor Cleaning Machines

Three different types of cleaning machines are included in this section: **batch vapor, in-line vapor** and **in-line cold**. Vapor-type cleaning machines heat the solvent above its boiling point. The parts are cleaned by the condensation of hot solvent vapor on colder parts. With this process, the parts to be cleaned go into and come out of the machine dry. In-line cold machines operate much like batch cold cleaning machines. The charts on page two and three summarize the rules for batch vapor and in-line cleaning machines.

Vapor & In-Line Cleaning Machines
(Choose from one of three options listed below.)

Compliance Options	Required Controls
Option 1 Control Combinations & Design & Work Practices	1. Use control devices/methods. Choose two or three of the control devices/methods in combination (see chart to the right). 2. Follow established design and work practices (see chart below).
Option 2 Idling Emission Limit & Design & Work Practices	1. Set limits on solvent emissions during idle mode. Idle mode is when machine is turned on but is not actually cleaning parts. Initial measurements are required to determine that the machine meets the idling emission limits and monitoring parameters to measure compliance. Monitoring specifications and test results from the equipment manufacturer may be used in place of actual tests. Test methods for determining idling emissions can be found in the rule. Batch Vapor 0.22 kg/m2 hour (0.045 lb/ft2 hour) In-Line 0.10 kg/m2 hour (0.021 lb/ft2 hour) **The amount of solvent in kilograms (pounds) emitted per square meter (foot) of solvent surface area per month. 2. Follow established design and work practices (see chart below).
Option 3 Overall Emission Limit Alternative Standard	1. Sets an emission limit for solvent cleaning machines. The emissions from each machine must not exceed a three-month rolling average. The amount of solvent emitted each month must be calculated based on how much solvent is added and removed from each machine. *Machine Type* — *Avg. Monthly Emission Limit ** in kg/m2 (lb/ft2)* Batch Vapor 150 kg/m2 (30.7 lb/ft2) Existing* In-Line 153 kg/m2 (31.4 lb/ft2) New* In-Line 99 kg/m2 (20 lb/ft2) *Existing = machines in operation on or before 11/29/93, New = start up after 11/23/93 **The amount of solvent in kilograms (pounds) emitted per square meter (foot) of solvent surface area per month.

Vapor & In-Line Cleaning Machines
Design & Work Practices

Design Requirements

1. Cover the machine or reduce room draft.
2. Have a 0.75 or greater freeboard ratio.
3. Set hoist maximum speed of 3.4 meters (11 ft) per minute.
4. Have liquid and vapor level indicators that shut off sump heat.
5. Primary condenser (required on vapor cleaning machines).

Work Practices

1. Minimize air disturbances in the cleaning machine and in the room.
2. Minimize solvent loss due to spraying operations.
3. Reduce the pooling of solvent on and in parts.
4. Remove parts only after solvent dripping stops.
5. During startup, turn primary condenser on before sump heater.
6. During shutdown, turn sump heater off before the primary condenser.
7. Maintain equipment as recommended by the manufacturer.
8. Store solvent waste in closed containers.
9. Do not clean absorbent materials.
10. Take and pass an operator test, if requested.
11. Transfer solvent using leakproof couplings and minimize emissions.
12. Parts or parts basket in a open-top batch vapor machine shall not occupy more than 50% of the solvent/air interface area unless the parts are introduce as a speed of 0.9 meters/minute (3 feet/minute).

Vapor & In-Line Cleaning Machines
Control / Methods Combinations

Choose two - three of the control devices or methods in combination (see below approved combination charts for more information). Options differ for batch vapor and in-line machines. For batch vapor, there are two sets of control combinations options, based on the solvent surface area within the machine. Smaller machines have more options than larger machines.

Batch Vapor

1. **Install a working-mode cover.** It completely covers the machine openings to minimize the influence of outside air disturbances while parts are being cleaned. Cover is opened only during parts entry and removal.
2. **Reduce room draft.** By decreasing the flow of air (from fans) across the top of the solvent cleaning machine to 50 ft per minute.
3. **Have a freeboard ratio of 1.0 or greater.** This effectively reduces solvent emissions. For example, if the height of the freeboard is 2 meters (6.6 ft) and the interior dimensions of the freeboard are 2 meters (6.6 ft) by 4 meters (13.2 ft), the freeboard ratio would be 2 meters/2 meters (6.6 ft/6.6 ft = 1.0).
4. **Use a superheated vapor system.** It heats the solvent within the vapor zone to at least 10°F above solvent's boiling point. Parts must be held within the superheated vapor zone to allow the solvent to evaporate from the part.
5. **Install a freeboard refrigeration device.** It is a set of coils mounted in the freeboard are that carries a refrigerant to provide a chilled air blanket above the vapor zone, which causes the solvent vapors t condense and return to the tank. The temperature measured from the center of the air blanket must not exceed 30% of the solvent's boiling point.
6. **Install a carbon adsorber in conjunction with a lip exhaust** to further remove solvent emissions. Exhaust from the carbon adsorber must not exceed 100 ppm.
7. **Use appropriate dwell time per type of part.** Dwell time is the amount of time cleaned parts are held above the vapor zone but within the freeboard area, allowing solvent to drain from the parts or parts basket back into the machine. This reduces solvent emissions and drag out. Dwell time must be at least 35% of the time required for a part or basket to stop dripping.

In-Line

1. **Have a freeboard ratio of 1.0 or greater.** This effectively reduces solvent emissions. For example, if the height of the freeboard is 2 meters (6.6 ft) and the interior dimensions of the freeboard are 2 meters (6.6 ft) by 4 meters (13.2 ft), the freeboard ratio would be 2 meters/2 meters (6.6 ft/6.6 ft = 1.0).
2. **Use a superheated vapor system.** It heats the solvent within the vapor zone to at least 10°F above solvent's boiling point. Parts must be held within the superheated vapor zone to allow the solvent to evaporate from the part.
3. **Install a freeboard refrigeration device.** It is a set of coils mounted in the freeboard are that carries a refrigerant to provide a chilled air blanket above the vapor zone, which causes the solvent vapors t condense and return to the tank. The temperature measured from the center of the air blanket must not exceed 30% of the solvent's boiling point.
4. **Install a carbon adsorber in conjunction with a lip exhaust** to further remove solvent emissions. Exhaust from the carbon adsorber must not exceed 100 ppm.
5. **Use appropriate dwell time per type of part.** Dwell time is the amount of time cleaned parts are held above the vapor zone but within the freeboard area, allowing solvent to drain from the parts or parts basket back into the machine. This reduces solvent emissions and drag out. Dwell time must be at least 35% of the time required for a part or basket to stop dripping.

Approved Batch Vapor Control Combinations

Cleaning Machine Type	Option	Working Mode Cover	1.0 Freeboard Ratio	Super Heated Vapor	Freeboard Refrigeration Device	Reduce Room Draft	Carbon Adsorber	Dwell
Batch Vapor Cleaning Machine ≤1.21 m^2 (≤13 ft^2)	1	■	■	■				
	2			■	■			
	3	■			■			
	4		■	■		■		
	5				■	■		
	6		■		■			
	7				■			■
	8		■			■		■
	9				■		■	
	10		■	■			■	
Batch Vapor Cleaning Machine ≥1.21 m^2 (≥13 ft^2)	1		■	■	■			
	2				■	■		■
	3	■		■	■			
	4		■	■		■		
	5			■	■	■		
	6		■	■	■	■		
	7			■	■		■	

Shaded boxes indicate the control devices or methods that can be used in combination for each option.

Approved In-Line Control Combinations

Cleaning Machine Type	Option	1.0 Freeboard Ratio	Super Heated Vapor	Freeboard Refrigeration Device	Carbon Adsorber	Dwell
Existing In-Line[a]	1	■	■			
	2	■		■		
	3			■		■
	4				■	■
New In-Line[b]	1		■	■		
	2			■	■	
	3		■		■	

[a] Existing = machines in operation on or before 11/29/93
[b] New = start up after 11/29/93

Notice of Construction

Existing and new sources of air contaminants throughout Washington must obtain an approved Notice of Construction (NOC) prior to the construction or installation of the air pollution control equipment, unless exempt.

Annual Registration & Fees

Operations with NOCs must also register with Spokane Clean Air* and are subject to annual registration fees, annual reporting of air emissions data and regular compliance inspections. The annual registration program enables us to maintain an inventory of air contaminants. Information is also used to evaluate air pollution control strategies to attain and maintain National Ambient Air Quality Standards. *Ecology does not have this requirement.

On-site Inspections

Regular inspections of registered sources are conducted to verify compliance with air pollution regulations. Inspectors also respond to citizen complaints regarding air pollution concerns. Complaint response typically results in an on-site inspection.

Are there benefits to using solvent alternatives ?

Yes. Eliminating or minimizing the use of toxic substances can help your business:

- reduce costs by using fewer raw materials;
- cut waste transportation and disposal costs; and
- reduce long-term liability and insurance costs.

Before looking at alternative cleaning options, it is important to understand your situation. Consider the following questions:

- What is being cleaned?
- What are the contaminants?
- How "dirty" are the parts prior to cleaning?
- How are the parts getting dirty in the first place?
- What are the minimum requirements for cleanliness that must be met for this process?
- Is a specific type of cleaning required by internal or external specifications?
- Is continuous or batch processing required?

How do I determine if an alternative method will work for me?

Alternative cleaning methods or materials include eliminating the cleaning process; using water-based or semi-water-based cleaning systems and/or materials; using citrus based or biological solvents, or using a specialty cleaning process, such as supercritical carbon dioxide or vacuum de-oiling. **The following three steps will help you analyze your cleaning process and possible alternatives.**

Step 1: Evaluate cleaning

- Check your minimum cleanliness requirements. You may be "overcleaning." If you can't eliminate cleaning, you may be able to reduce the amount of cleaning (see Step 2 & 3.)
- Investigate controlling the contamination of parts. You may find that you can meet minimum cleanliness requirements without cleaning. If not, you may be able to reduce the load on the cleaning system (see Step 2 & 3.)
- Investigate process changes that make cleaning unnecessary. If you are cleaning because of residue put on a part by a current process, see if there is an alternative process that meets your needs without leaving any residue (or that leaves residue that can be left on).
- Work to change internal specifications that require cleaning, if you can prove it is not technically necessary. If external specifications require cleaning with a regulated substance, inquire with the customer if a change would be acceptable. If not, refer to the required equipment controls and work practices (see charts on page 1, 2 and 3) and Step 3.

Step 2: If cleaning is still required, consider an alternative cleaning process

- Determine which alternatives are compatible with your parts and will remove contaminants, based on information from vendors, peers or others. Try to identify water-based alternatives.
- Identify which of the compatible alternatives is most economical and convenient.
- Have enough representative parts "test cleaned" to verify that the alternative will work, and to identify any modifications you'll need to make to use the new process.
- Work to change internal specifications that require a specific cleaning process if you can prove a viable alternative exists. If external specifications require cleaning with a regulated substance, inquire with the customer if a change is acceptable.

Step 3: If alternatives are not feasible, optimize current cleaning process

Implement the design and work practices listed in the information sheet:

- batch cold cleaning machines (see page 1)
- vapor and in-line cleaning machines (see page 2 and 3)

Resources:

- Pacific NW Pollution Prevention Resource Center, www.pprc.org
- EPA & Design for the Environment, www.epa.gov/dfe/
- Ecology, www.ecy.wa.gov

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