Reducin' Pollution

An Environmental Health and Safety Guide
for the Fibreglass Industry

Volume 2: Workbook

NOVA SCOTIA
Environment and Labour

i. Purpose of the Guide

The purpose of this guide set is to provide an up-to-date reference of some of the 'Best Practices ' used in the fibreglass industry today. The focus of this guide is health and the environment, but most initiatives listed will positively impact quality and productivity as well.

ii. The *Reducin' Pollution* Workbook

This workbook has been produced as a companion piece to the *Reducin' Pollution* guidebook. This workbook is a tool that can help fibreglass companies quickly identify how they can improve their environmental performance and develop an action plan.

iii. Acknowledgments

The Canadian Plastics Industry Association and the Nova Scotia Department of Environment and Labour would like to acknowledge the Nova Scotia Composites Environmental Health and Safety Working Group for their assistance in preparing this guide. In particular, they would like to thank Sandy Marshall, Sean O'Brien and Tony Sampson for their time and effort.

iv. Disclaimer:

The authors and sponsors of this guide intend for it to help improve the health and sustainability of the fibreglass industry. Every effort has been made to ensure the information is accurate and up to date. The authors and sponsors do not accept responsibility for accidents, incidents or other problems resulting from anyone following the practices recommended in this guide.

This guide provides information on the benefits of pollution prevention for the fibreglass industry in Nova Scotia. It also provides information on some of the relevant laws in effect in Nova Scotia. It does not provide information on how to comply with all provisions of those laws that may apply to businesses. This guide is not intended to replace reading the legislation and regulations or seeking advice from a lawyer or an environmental expert. Examples and interpretations given are not binding on the Crown. Amendments may be made to the legislation or regulations after the publication of this document and reference should be made to the most recent official version of the legislation and regulations.

Table of Contents

1 The Pressures for Change on the Fibreglass Shop

- Today's fibreglass and Fibre Reinforced Plastics (FRP) shops face many challenges that will require change:
  - ⇒ *Profitability*
  - ⇒ *Technical advances*
  - ⇒ *Occupational health and safety*
  - ⇒ *Environmental performance*
  - ⇒ *Complying with Regulations*
- The FRP Industry is a source of hazardous volatile emissions to the environment. **Styrene** and **acetone** are the largest contributors.

Key Issues

- Volatile Organic Compounds (VOCs)
  - ⇒ VOCs are chemical vapours emitted by fresh resin surfaces and by solvents such as acetone.
  - ⇒ Styrene is a key VOC found in fibreglass shops.
  - ⇒ In general, about half of styrene emissions occur during lay-up or spray-up with the other half given off by curing resin.
  - ⇒ Exposure to VOCs can cause irritation of the eyes, nose and throat, skin problems, nausea and dizziness.
  - ⇒ VOCs help to create smog.
- Odour Emissions
  - ⇒ Odour emissions can disturb people living or working near FRP shops.
- Drum Disposal and Recycling
  - ⇒ Left-over liquids in empty drums can be toxic or hazardous and must be disposed properly.
  - ⇒ Improperly disposed drums can cause health impacts and contaminate soil and groundwater.
  - ⇒ Empty drums should be returned for proper disposal or for recycling.

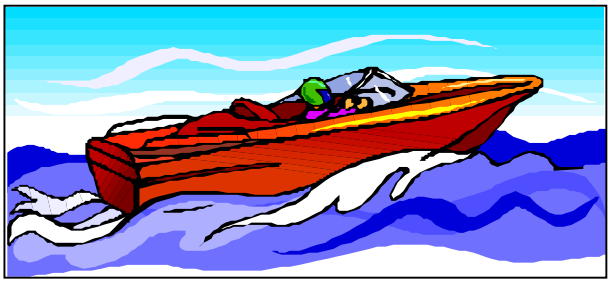
- Water Quality Management
  - ⇒ Water pollution can occur when contaminants are washed away by stormwater or rain or when discarded down the drain.

- Waste Management
  - ⇒ The disposal of solid waste is regulated in Nova Scotia.
  - ⇒ The most cost-effective way to manage your waste is to not generate it in the first place.
  - ⇒ Waste can be sorted for reuse, recycling and safe disposal.

- Hazardous Materials
  - ⇒ The storing, labeling and handling of hazardous materials (also referred to as dangerous goods) is regulated by the province through the Dangerous Goods Management Regulations and the Occupational Health and Safety Regulations.
  - ⇒ Hazardous materials are extremely dangerous in uncontrolled situations and cause serious injury or adverse environmental affects.

- Dust Management
  - ⇒ Fibreglass dust in the air can be a nuisance and is a physical hazard.
  - ⇒ Fibreglass dust is combustible and can be a fire hazard in the workplace.

- Noise Management
  - ⇒ Noise pollution can disturb people living or working near FRP shops.



2 Pollution Prevention and You

- The simple idea behind pollution prevention (P2) – prevent pollution by not creating it in the first place
- Reasons for P2 are all around us:
  - ⇒ Children, family, and friends
  - ⇒ Protecting the air, drinking water, and soil
  - ⇒ Protecting watercourses such as streams, lakes and rivers
  - ⇒ Protecting land areas such as forests, fields, and residential areas
- Involves rethinking how we do things
  - ⇒ Simple changes in behaviour and workplace practices can prevent pollution and not be costly
- Pollution prevention can save money
- Benefits of P2 to the workplace include:
  - ⇒ The reduced costs of using fewer raw materials
  - ⇒ Improvements to worker health and safety and environmental performance
  - ⇒ Lower costs on ventilation and safety equipment
  - ⇒ Easier compliance with regulations and reduced paperwork burden
  - ⇒ Reduced waste transportation and disposal costs
  - ⇒ Reduced long-term liability and insurance costs
- P2 focuses on areas such as:
  - ⇒ The use of hazardous and dangerous materials
  - ⇒ Using natural resources efficiently
  - ⇒ Conserving natural resources
  - ⇒ Improving production processes to create less waste
  - ⇒ Training
  - ⇒ Modifying or improving equipment
  - ⇒ Using more environmentally-friendly materials
  - ⇒ The design or formulas of products
  - ⇒ Product life-cycles
  - ⇒ Purchasing practices

3 Pollution Prevention Best Practices for the Fibreglass Shop

This section outlines some of the best practices in use for Pollution Prevention. Regulatory issues are also noted to point out compliance issues. New ideas and regulations are being generated on a continuous basis so this list should not be considered complete. These are just some of the options that are available. Businesses are encouraged to demonstrate their leadership and innovation by incorporating other pollution prevention methods into their own business operation

To help you identify the practices that most interest you, practices of note are indicated with any number of three icons.

This icon tells you when a best practice can save you money.

This icon indicates that a practice can help you lower your shop's levels of volatile vapours such as styrene or VOCs.

Practices that deal with regulations and the law are indicated with this icon.

All of the practices listed in this workbook are described in greater detail in the *Reducin' Pollution* Guidebook.

How to Use This Workbook

In this workbook, the pollution prevention best practices are organized into tables. Checkboxes labeled "Yes" and "No" are found on the right side of the tables. If the practice listed is one used in your fibreglass shop, place a checkmark next to it in the "Yes" box. If the practice is not used in your shop, then place a checkmark in the "No" box. There may be some cases where a particular practice does not apply to your shop. In these cases, simply write "DNA" for "does not apply" in either the "Yes" checkbox.

After each section, review your checklist to see what pollution prevention best practices you can add to your operation. For each practice that received a "no" checkmark, write these practices in the space below as your "Action Items" and check them off once they are completed.

3.1 Designing your Product

Designing your products with efficiency in mind can save money and minimize pollution *before* you start building! (See **page 6** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Optimize the design of your product 		
Use core materials to strengthen your design while using less glass and resin. 		
Use engineered reinforcements to increase the strength of your product 		
Use non-hazardous fillers when building large pieces 		
Substitute hazardous products with less hazardous ones where possible 		
Specify low styrene resins and gelcoats 		
Incorporate flanges into your mould design 		
Educate your customers on "Environmentally Friendly" alternatives		
Consider the end-of-life recyclability of your finished product when designing it		

My Action Items

Action Item	Completed?

3.2 Purchasing your Raw Materials

The type and amount of product or raw materials purchased directly impacts on the degree of environmental risk and the ease of complying with regulations. Use your purchasing practices to reduce pollution, minimize your waste, and save your company money. (See **page 7** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Purchase smaller quantities to limit storage and age expiry issues		
Assess the true cost of your raw materials		
Track production to allow for smaller inventories		
Purchase products in recyclable containers that use a minimum amount of packaging		
Encourage suppliers to demonstrate new products and ideas		
Use local materials and recycled materials where possible		

My Action Items

Action Item	Completed?

3.3 Storing your Materials

Properly storing dangerous goods such as resin, catalysts, solvents, release agents and other products is crucial for all fibreglass shops. Improperly stored dangerous materials are a threat to worker health, the environment and are also against the law! (See **page 8** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Keep minimum quantities 		
Track your inventory closely 		
Train your workers on WHMIS, regulations, and emergency procedures 		
Report the spill, leak or release of any dangerous or hazardous materials 		
Store all flammable and reactive materials safely and according to regulations 		
Keep a safe and clean storage area 		

My Action Items

Action Item	Completed?

3.4 Pouring and Mixing your Materials

Bad pouring and mixing practices do more than emit styrene and release VOCs to the air. They can also cause adverse environmental impacts, contaminate property, and pollute watercourses and groundwater. Sloppy pouring and mixing also wastes product and can create dangerous, explosive situations. (See **page 9** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Order your products pre-mixed, and always agitate the drums before using 		
Improve your tracking system to account for substance use and waste generation		
Modify your production schedule to improve the efficiency of your process 		
Label your products and wastes as specified by the WHMIS regulations 		
Follow the proper procedures for mixing and transferring product and cleaning tools		
Use a proper electrical system, inspect it regularly and eliminate sources of static charges		
Practice good housekeeping 		

My Action Items

Action Item	Completed?

3.5 Producing your Fibreglass Product

A major source of the hazardous volatile emissions emitted by fibreglass shops occurs during production and the product lay-up or spray-up. There are several ways in which a fibreglass shop can modify its practices to reduce these emissions. This section examines how to improve production methods, systems and equipment. (See **pages 10 and 11** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Production Methods		
Where appropriate, invest in a closed-mould system instead of open-mould (e.g. infusion, vacuum or resin transfer processes) 		
Use styrene suppressants in the resin to limit emissions 		
Apply a thicker lay-up or spray-up at one time 		
Manage your cure system through good catalyst practices, and trial alternative cures 		
Production Systems		
Improve the production schedule to maximize process efficiency 		
Use the best equipment and materials suited for the job and use only what you need 		
Track the use of materials, waste generation and costs 		
Improve housekeeping and maintenance 		
Improve worker training and awareness 		

My Action Items

Action Item	Completed?

Practice	Yes	No
Production Equipment		
Use non-atomized resin applicators such as fluid impingement, flow coaters or pressure-fed roller impregnators to apply resins and gelcoats 		
Use a mill gauge when applying gelcoats to measure the thickness of the application 		
Install overspray flanges on all moulds to reduce the area of overspray 		
Use in-line resin heaters instead of extra styrene to improve the flow of resin 		

My Action Items

Action Item	Completed?

3.6 Training and Awareness in the Workplace

When encouraging workplace employees to adopt new and safer practices, training and awareness is key. There are many new and safer production techniques that workers can use if they are shown how. (See **page 12** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Show spray operators how to use controlled-spraying techniques 		
Train operators to apply only specified amounts 		
Make it a routine practice to follow the proper procedures for mixing, transferring and applying gel coats and laminates and for cleaning and maintaining equipment and moulds		
Provide employee training on regulations, emergency procedures, and on health and safety issues 		
Train staff on proper housekeeping practices 		
Train employees on how to use emergency equipment - and keep the equipment in a convenient, visible location 		
Wear gloves and avoid using acetone to wash hands		

My Action Items

Action Item	Completed?

3.7 Cleaning your Equipment and Tools

Not only will these steps improve the quality of the air in your shop, it will also reduce your risk of harming the environment and improve the environmental performance of your company. (See **page 13** of the Best Practices guide for more information on these practices)

Best Practices

Practice	Yes	No
Switch to a non-VOC type cleaning solution 		
Use cleaning solvents for a longer period of time 		
Use the "two buckets" washing system - one is clean, and the other is dirty 		
Keep lids on all buckets 		
Install a gun cleaning tank or unit 		
Ration solvents and other material 		
Limit the number of cleaning buckets in the workplace 		
Physically remove excess resin from tools before using a solvent wash 		
Collect all used solvent and recycle it "in-house" or by using contractors		

My Action Items

Action Item	Completed?

3.8 Managing your Waste

Responsible waste management is not just a sound environmental and economic practice, but it is also legislated in Nova Scotia. Reducing your waste and managing it properly can result in lower tipping fees, reduced transportation costs, and cost savings through the reuse and recycling of materials. (See **page 14** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Keep your workplace tidy and well-maintained 		
Identify wastes with clear and easy-to-read labels 		
Keep lids on all wastes 		
Use all of the product from the drums 		
Store empty drums properly		
Minimize the amount of grinding, cutting and sanding that you have to do 		
Collect dust at the source using well-placed vents and vacuums		
Develop a waste management system to that allows your workplace to separate, reuse and recycle its waste		
Dispose of hazardous waste and solid waste properly 		
Do not open-burn wastes (e.g. barrel burning) 		

My Action Items

Action Item	Completed?

3.9 Designing your Facility

Pollution prevention should be incorporated into the design of any production facility. A wide range of considerations should be included, such as energy efficiency, waste management, noise pollution, and others. (See **page 15** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Design and maintain your facility to be energy efficient in order to reduce heating and electrical costs 		
Limit the size of your lay-up area to reduce ventilation and heating requirements 		
Use proper temperature controls in the production areas to improve process efficiency		
Plan your ventilation system to reduce the overall air-flow while controlling dust and chemical hazards 		
Design for emergencies, fire protection and spill containment 		

My Action Items

Action Item	Completed?

4 Resources

4.1 Government Departments

Nova Scotia Environment and Labour

Phone: (902) 424-5300
Toll Free: 1-877-9ENVIRO
Fax: (902) 424-0503

Website: http://www.gov.ns.ca/enla/
Pollution Prevention website: go to the NSEL website, click on "Information and Services", and find Pollution Prevention under "P" in the index.

Office of the Fire Marshall

Phone: (902) 424-5721
Toll Free: 1-800-559-3473 (FIRE)
Fax: (902) 424-3239

Website:
http://www.gov.ns.ca/enla/ofm/index.htm

For more information on the government regulations described in this guide, please visit the following websites:

Regulations under the Occupational Health and Safety Act (including the general regulations, first aid regulations and the WHMIS regulations)
http://www.gov.ns.ca/enla/ohs/publicat.asp

Dangerous Goods Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envdgm.htm

Petroleum Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envpetma.htm

Used Oil Regulations
http://www.gov.ns.ca/just/regulations/regs/env17996.htm

Air Quality Regulations
http://www.gov.ns.ca/just/regulations/regs/envairqt.htm

Solid Waste-Resource Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envsolid.htm
http://www.gov.ns.ca/enla/emc/wasteman/ (Solid Waste Resource Management branch homepage)

Emergency Spill Regulations
http://www.gov.ns.ca/just/regulations/regs/env5995.htm

5 Glossary

Acetone: is a solvent commonly used in fibreglass shops for cleaning tools and equipment.

Barrel Burning: is the act of burning waste in a barrel or drum. It generates significant amounts of pollution and is prohibited in Nova Scotia.

Catalysts: are added to epoxy and polyester resins to make them harden. Also referred to as hardeners.

Closed-Mould Systems: are those that completely encase the resin within a mould. The resin then cures while sealed from the open air.

Compaction Roller: is a serrated or bristle roller that comes in various shapes. It is used on most laminates to provide compression and movement of the reinforcement in order to ensure wetout and to remove trapped air.

Controlled-Spraying: is a method of applying fibreglass resin using a spray gun and closed containment mould flanges. It reduces styrene emissions by minimizing the amount of spray gun atomization and by reducing the amount of overspray lost off the mould edge.

Core Materials: are used to stiffen fibreglass laminates. Examples of core materials used are balsa wood, foam, or honeycomb.

Curing: is the chemical reaction that takes place while the catalyzed resin changes from a liquid to a solid. Heat is generated during this process and as much as 50% of the styrene emissions occur.

Dangerous Good: is defined in the Dangerous Goods Management Regulations as a substance that conforms to the criteria set out in the federal Transportation of Dangerous Goods Regulations or is designated as a dangerous good in Schedule B of the federal Transportation of Dangerous Goods Regulations. This generally includes (but is not limited to) products, substances or organisms are included in at least one of the nine following classes: explosives, gases, flammable liquids, flammable solids, oxidizing substances, poisonous or infectious, radioactive, corrosive, or miscellaneous.

End-of-Life: refers to the period when a product is no longer usable or wanted.

Engineered Reinforcements: are synthetic – or man-made - materials that can be used to add rigidity or strength to fibreglass forms. Examples include knitted fabrics, three-dimensional fabrics, carbon fibre, aramid fibres such as Kevlar, and high tension steel wire.

Flow Coater: is a mechanical resin applicator that uses a catalyzing resin pump with a number of low pressure streams to deliver catalyzed resin directly to a laminate. A flow coater can also be outfitted to deliver chopped glass fibres.

Fluid Impingement System: is a delivery system that creates a flat, fan shaped sheet of catalyzed resin by shooting two high pressure streams of resin at each other at a precise angle. The catalyst can be mixed with the resin within the gun (an internal mix) or as it exits the spray tip (an external mix). The system can be used to deliver chopped glass fibres as well.

Groundwater: is the water system that flows under the ground. Groundwater often flows into (and in some cases replenishes) drinking wells, water receivers, lakes, and streams.

Hand Lay-Up: is the process of manually placing the fibreglass reinforcements (such as mats, woven roving, knits, etc.) into the mould or onto part, where resin is then applied mechanically or manually.

Infusion Resin Transfer: is the process of filling an enclosed reinforcement layer with resin. This is usually done by a vacuum drawing the resin into the emptied air spaces. It can also be assisted by applying pressure to the resin to help push it through the fibres.

In-Line Resin Heater: is a device that warms resin in the spray-gun line in order to make it more fluid.

Mill Gauge: is used to measure the thickness of gel coats.

Non-Atomized Application: is a method of applying resin to a fiber reinforcement using a fluid delivery device without atomizing the resin. This includes flow coaters, flow choppers, and pressure fed rollers.

NSEL: Nova Scotia Department of Environment and Labour.

Open-Mould Systems: are those that saturate reinforcement fibres (e.g. glass fibres) with resin and then use a manual roll-out technique to consolidate the laminate and remove the trapped air. The resin then cures in the open air.

Overspray Flanges: are used on a spray-mould to capture overspray and minimize the amount of wet resin that is deposited off the edge of the mould. Overspray flanges can be built into the mould as a permanent extension of existing flanges or as a part of the mould that has been designed specifically for controlled spraying.

Release Agents: are layers of material applied to the mould's surface to prevent the product from sticking. The release agent can be a wax, a fluid chemical like wax, or a solid sheet like mylar.

Resin: is the liquid component that is mixed with the glass fibers to make a fibreglass or composite product. Typical resin classes used by fibreglass manufacturers include polyesters, epoxies, vinyl esters and DCPDS.

Smog: is a hazy chemical fog made up mainly of ground-level ozone formed by a reaction between volatile organic compounds and nitrogen oxides in the atmosphere. Adverse health impacts due to smog include itchy and watery eyes and respiratory problems.

Solvents: are chemical liquids commonly used by the fibreglass industry to clean equipment and tools. Acetone is the most commonly used solvent, and others include methyl ethyl ketone and methanol.

Spray-Up: is the practice of applying the fibreglass (or gun roving) mechanically with a chopper on a spray applicator.

Styrene: is a volatile organic compound emitted by most curing resins. It is also considered a reactive dilutent, which means that some of the styrene becomes a part of the finished product through the chemical process of curing. Epoxy resins are one type of resin that does not contain styrene.

Threshold Limit Value: is the maximum concentration of a chemical recommended for repeated exposure without adverse health affects on workers.

Transfer Efficiency: is a ratio of the amount of material sprayed compared to the amount that ends up on the mould surface.

Time Weighted Average Concentration: is the average concentration of an airborne substance that an individual can be exposed to over an eight-hour day.

TLV: See Threshold Limit Value

TWA: See Time Weighted Average Concentration

Vacuum Resin Transfer: involves covering the resin and fibreglass with a plastic vacuum bag and using a vacuum to saturate the fibreglass with the resin.

Volatile Organic Compounds: also known as VOCs, are types of gases that are emitted into the air by resins and solvents. Acetone vapour and styrene are two of the most common VOCs found in fibreglass shops. Exposure to VOCs can irritate the eyes, nose and throat, and cause nausea, dizziness and skin problems. Exposure to higher concentrations can cause anxiety and memory problems.

(VOCs): see Volatile Organic Compounds

Waste Dangerous Goods: are dangerous goods that are no longer in use for their original purpose or are materials that have become waste dangerous goods through their handling. This includes dangerous goods intended for treatment, disposal or recycling, but it does not include dangerous goods that have been returned directly to the manufacturer or the supplier of the dangerous goods for reprocessing, repacking or resale. This also does not include consumer paint products as defined in the Solid Waste-Resource Management Regulations.