Toxics Reduction Plan

Volatile Organic Compounds

Prepared by:

TI Group
115 Thorncliffe Park Dr
Toronto ON
M4H 1M1

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1.0 General Information

Toxic Substance	Volatile Organic Compounds 64742-48-9 – Hydrotreated heavy naphtha 64742-95-6 – Light aromatic solvent naphtha
Number of full-time equivalent employees	58
NAICS	323119 Other Printing
NPRI ID	511190
UTM NAD83 coordinates (entrance)	633417, 4840883

Canadian Parent Company

Legal name	
CCRA business number	

Contact info

Owner and operator of facility	TI Group Inc. 115 Thorncliffe Park Dr Toronto, ON M4H 1M1
Highest ranking employee	Robert Marcotte Plant Manager (416) 696-8322 bmarcotte@tigroup.ca
Person who coordinated preparation of plan	Robert Marcotte Plant Manager (416) 696-8322 bmarcotte@tigroup.ca
Person who prepared plan	Wendy Nadan Nadan Consulting Ltd 151 Montgomery Blvd Orangeville ON L9W 5C1 519 940 4724 wendy@nadanconsulting.com
Public contact	Robert Marcotte Plant Manager (416) 696-8322 bmarcotte@tigroup.ca
Technical contact	Wendy Nadan

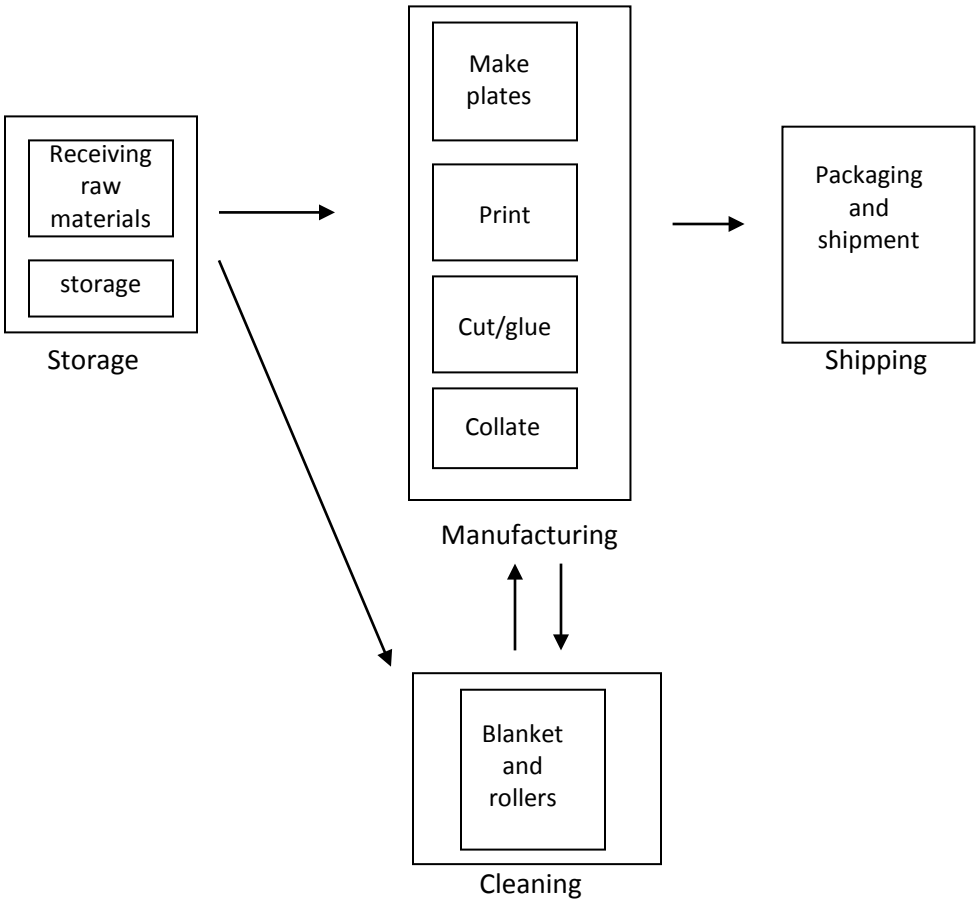
	Nadan Consulting Ltd 151 Montgomery Blvd Orangeville ON L9W 5C1 (519) 940 4724 wendy@nadanconsulting.com
Planner	
License number of planner	Wendy Nadan Nadan Consulting Ltd 151 Montgomery Blvd Orangeville ON L9W 5C1 519 940 4724 wendy@nadanconsulting.com TRSP 0092

2.0 Statement of Intent

TI Group is committed to reducing the environmental impact of its manufacturing operations. Management will continue to explore options to reduce the usage of toxic substances while providing innovative solutions to our customers.

TI Group has prepared this toxic substance reduction plan for VOC to investigate options to reduce the usage of VOCs while supplying customers with products that meet their needs. Employees will be trained to use the minimum quantity of solvent necessary for cleaning and to keep all containers closed.

3.0 Identification of Stages and Processes



A tour of the facility was undertaken to identify individual processes. These processes were broken down into the storage, manufacturing, cleaning and shipping stage.

64742-48-9 – Hydrotreated heavy naphtha is used in blanket wash (Autowash 6000)
64742-95-6 – Light aromatic solvent naphtha is used in blanket wash (Autowash 6000, UV REL)

4.0 Manufacturing Process Description

Sheetfed Lithographic

TI Group manufactures commercial print products on a paper substrate using sheetfed lithographic printing. Computer to Plate (CtP) processing is used to manufacture litho printing plates. The printed image is created electronically. The image is stored in a digital file that is sent electronically to the plate maker. The plate processor uses aqueous chemistry in a closed tank to remove surface material from the imaged plate but has no oven and there is no direct ventilation to outside. The plate developer may contain some VOCs.

The plate is installed on the press. During the lithographic process, the non-image areas of the plates are first coated with a monolayer of lipophobic fountain solution. Ink is transferred from the ink pan by the ink roller to the plate. The ink is applied to the areas of the plate that are lipophilic i.e. free of fountain solution. The plate then transfers the ink to the press blanket roller, which then transfers the ink from the blanket to the sheet (offset printing).

The print units are chilled to maintain optimum viscosity of solutions and ink. Variation of the temperature leads to scumming of the plate and quality problems.

Fountain solution used on the printing press consists of fountain solution concentrate diluted in water in a ratio of approximately 1:30. The fountain solution is used to coat the non-image portion of the plate and make it unreceptive to ink. Additives such as glycol ethers and isopropyl alcohol in the solution reduce the surface tension to ensure coverage on the plate in non-image areas. One hundred percent of the VOCs in the fountain solution evaporate into the general atmosphere from the plate and paper.

After imaging using sheetfed presses, the solvent in the ink draws the pigments and resins into the pores of the sheet. During this drying/penetration process, five percent of the VOCs in the ink evaporate into the general atmosphere. Emission factors for sheetfed inks are taken from the *Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing' EPA-453/R-06-002. U.S Environmental Protection Agency, September 2006*.

Coatings may also be applied to the substrate after printing to provide the desired finish, either glossy or matte. The coatings are either aqueous or UV and cured by infra red or UV radiation. UV coatings have no VOC constituents. Aqueous coatings may contain a few percent of isopropyl alcohol which is driven off in the drying process.

The lithographic printing presses are cleaned both using automatic blanket washers and manually. Cleaning is required to remove build up of paper dust and ink to maintain printing quality.

For manual cleaning, solvent is dispensed onto a recyclable cloth wiper, the blanket is wiped clean and the used wiper is discarded into a closed wiper bin. Due to the low vapour pressure (<10mmHg), it is assumed that half of the solvent used evaporates into the general atmosphere as a fugitive emission. Since most cleaning tasks involve the blanket and rubber rollers, the cleaning solvents have to be compatible with the rubber surface. For this reason, solvents are generally low vapour pressure petroleum distillates. If water solubility is required to remove paper dust, glycol ethers are used.

Automatic blanket cleaners can be of the spray and brush type, spray and dry cloth or impregnated cloth. Rollers are cleaned separately by spraying a solvent onto the roller train and collecting dirty solvent at the bottom. As roller cleaning relies on solvent alone, more solvent is used than for cleaning blankets. However, rollers are usually cleaned less frequently than blankets.

Impregnated cloth cleaners are found in each print unit and clean the blanket only. The automatic cleaner engages, pressing the cloth against the surface and rotates, cleaning debris from the surface. The cleaner then disengages. The impregnated cloth uses a vegetable ester solvent that is virtually VOC free. The used cloth is disposed of as general garbage. This type of blanket washer uses the least amount of VOCs.

Spray and brush and spray and dry cloth cleaners are equipped with a solvent tank located under the press. The tank has separate reservoirs for solvent and water. During a cleaning cycle, a mixture of solvent and water is sprayed onto the surface. With a brush cleaning system, the brush cleans the surface and then the surface is rinsed off with water and the waste collected in a second tank under the press. With a dry cloth system, the solvent is wiped off onto the dry cloth. Thus the dry cloth both cleans and dries the blanket whereas the brush leaves a wet blanket that dries off onto the paper. The dry cloth system uses less VOCs than the spray and brush type cleaning system.

Cleaning cycles are controlled by the press operator. The blankets may be cleaned after every run, after so many impressions or when the blankets are dirty. Likewise a short or longer cleaning cycle may be selected based on operator preference. It is possible to alter the solvent water mix ratio and whether a pure solvent or pure water cycle is included.

Solvents used in automatic washers are also petroleum distillate based with possibly glycol ethers to provide water solubility. Waste conventional solvent is distillated on site for reuse. Waste UV solvent is collected and sent offsite for recycling before being returned for reuse. UV solvent is used for cleaning blankets and rollers using hybrid UV inks to print on synthetic substrate.

Some of the presses also have automatic washers for the rollers. Due to splashing of dirty solvent onto the clean rollers, the washup tray is lined with rags and the used solvent absorbed into the rags. The rags are then sent offsite for cleaning.

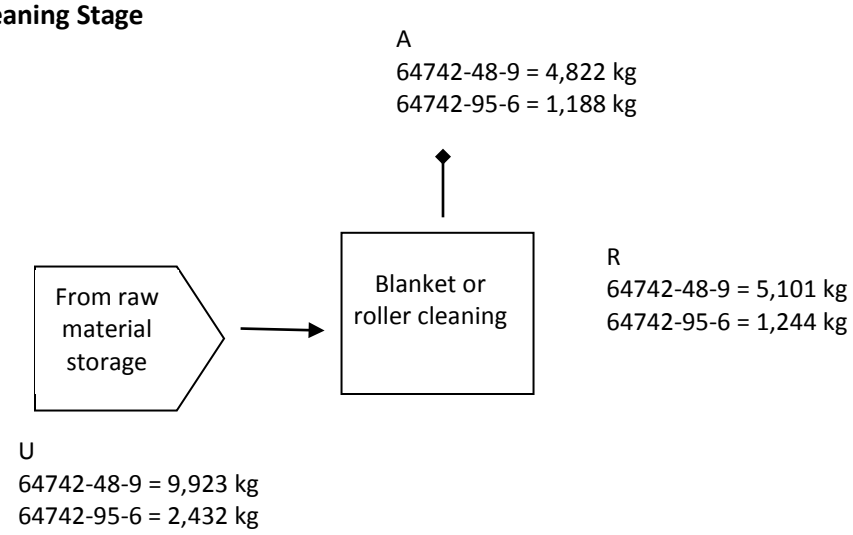
There are three sheetfed presses on site. The presses utilize an alternative automatic blanket cleaning system in which solvent and water are sprayed onto the blanket, excess solvent drips into a waste container underneath the press and the blanket dries onto the substrate.

Specialty cleaners such as rubber rejuvenator and metering roller cleaner are more aggressive cleaners used for a deeper clean and to evaporate quickly from the surface. They may contain alcohols and ketones.

Press cleaning solvents are received in drums that are stored in a solvent storage room. Solvent is dispensed into safety cans for use on the press.

5.0 Material Accounting

Cleaning Stage



VOC is used as a manual and automatic cleaner for blankets and rollers. When cleaning the rollers, the drip tray is lined with wipers, solvent is dispensed onto the top roller and dirty solvent collects in the drip tray. The saturated wipers are shipped off site for laundering.

As it is not possible to determine how much wash is used for blanket cleaning vs roller cleaning. It is assumed that all of the wash has been used in blanket cleaning.

Quantification Method Used
The amount of cleaning solvent purchased is known from purchasing records.

The Autowash 6000 and UV REL are used in automatic blanket washers that spray solvent onto the blanket and collect waste directly at press. The autowash waste is shipped off site for recycling; the UV REL is shipped off site for disposal. The remainder is emitted to air.

Alternative methods of quantification of air emissions are continuous emissions monitoring and stack testing. Both of these methods incur significant cost and were not considered cost effective methods.

Material Balance
The quantity of wash entering the facility was obtained from manufacturer and supplier information and the hence the quality is considered high. There are no VOCs created in the facility.

The quantity emitted to air is obtained using a mass balance. As a mass balance approach to material accounting is used, inputs and outputs are considered approximately equal.

6.0 Estimated Direct and Indirect Costs

Raw materials	
Cost of Autowash 6000 @$610/drum	$49,410
Cost of recycled Autowash 6000 @$300/drum	$1,500
Cost of UV REL @$907/drum	$9,000
Labour	
Labour cost to clean presses @100/hr*2,250 (250 days * 3 presses * 3 man hours per day)	$22,500
Waste	
Cost to launder wipers	$26,000
Cost to ship waste solvent 84 drums @$100/drum	$8,400
Health and safety compliance	
Safety Equipment	$2,000
Environmental compliance	$6,000

The total cost of environmental compliance is included although there are multiple substances that contribute to the necessity of regulatory compliance. Thus these contributions are likely to be an overestimate for toluene.

- NPRI/Reg.127/01 Collect information, Make copies of M.S.D.S., Contact Suppliers for most recent copies of M.S.D.S. & prepare documents for consultant.
- Toxics Reduction Plan, collect information
- Environmental Compliance Approval Air

Total Costs $124,810

7.0 Identification of Options for Reduction in Usage of VOCs

The following options were identified to reduce the usage of VOCs. Since VOCs are not created in the facility, there are no options to reduce creation.

Category	Description
Material substitution	Option 1: Use a lower (70%) VOC blanket and roller wash. Autowash 6000 and UV REL are all 100% VOC washes. This is estimated to result in reduction in usage of 30% of 64742-48-9 = 2,977kg, 64742-95-6 = 730kg and reduction in emissions to air of 64742-48-9 = 1,447kg 64742-95-6 = 356kg. Option 2: Clean the machine using dry ice instead of organic solvents. Blasting the surface with dry ice relies on mechanical rather than chemical action. Dry ice is solid carbon dioxide, an inert substance found in the air in small concentrations. Dry ice can be used to blast surfaces to remove contaminants as an alternative to other cleaning methods. After application, the dry ice sublimates leaving only the debris from removed soils. Use of dry ice for cleaning necessitates the use of special equipment and workers must take precautions to protect themselves from flying particles and extreme cold temperatures. Because dry ice sublimates at -79C, it cannot be stored for long and if needed on a regular basis is best generated in situ. This option would reduce the usage by 64742-48-9 = 9,923kg and 64742-95-6 = 2,432kg or 100% and air emissions by 64742-48-9 = 4,822kg, 64742-95-6 = 2,432kg or 100%.
Product Design	Option 3: Provide materials in electronic format. This option would reduce the usage by 64742-48-9 = 9,923kg, 64742-95-6 = 2,432kg or 100% and air emissions by 64742-48-9 = 4,822kg, 64742-95-6 = 2,432kg or 100%.
Process modification	Option 4: Retrofit impregnated cloth automatic blanket washers to presses. Assuming all the solvent used is to clean the blankets, this option would reduce the usage by 64742-48-9 = 9,923kg and 64742-95-6 = 2,432kg or 100% and air emissions by 64742-48-9 = 4,822kg, 64742-95-6 = 2,432kg or 100%. Option 5: Print all product digitally. Digital printers do not require routine cleaning and eliminates the need for solvents. This option would reduce the usage by 64742-48-9 = 9,923kg and 64742-95-6 = 2,432kg or 100% and air emissions by 64742-48-9 = 4,822kg and 64742-95-6 = 2,432kg or 100%.
Spill and leak prevention	Option 6: Keep all containers closed when not in use. Immediately dispose of cleaning wipers in closed safety cans. This is currently standard practice and is not expected to result in any reduction in the use of VOCs. Option 7: Provide secondary containment for all solvent containers. Solvents are currently stored in a flammables room that was built with a containment

	tank. This option will not be pursued further.
Reuse or recycling	Option 8: Install an on-site recycling unit. Currently solvent is recycled off site and returned for reuse so will not result in any decrease in usage or emissions.
Inventory management	Solvents used do not have a shelf life and hence can be stored indefinitely. The facility operates a JIT ordering system however to keep inventory to a minimum. Thus there is no option in this category.
Training	Option 9: Train all operators to keep containers closed and use minimum solvent for cleaning. As wash is very volatile, it evaporates very quickly and is lost to air. As this is currently best practice it is not expected to result in any reductions to usage and will not be pursued further.

8.0 Assessment of Technical Feasibility

Each of the options identified above were screened for technical feasibility using the following criteria:

- Availability and reliability of technology
- Impacts on quality, reliability, functionality
- Impact on production rate
- Compatibility with customer requirements
- Availability of employee training
- Compatibility with existing processes
- Space within facility
- Time required for change

Option	Technical Feasibility	Feasible
Option 1: Use low (70%) VOC wash	70%, 50%, 30% and 10% washes are available in the Canadian marketplace. 70% washes have been successfully implemented in other printing facilities.	Yes
Option 2: Use dry ice for cleaning	Cleaning time would increase as parts would need to be removed from the press to avoid damage to adjacent parts. The very low temperatures of dry ice make the rubber blankets and rollers brittle causing rapid deterioration.	No
Option 3: Provide materials in electronic format	Customers require that their products are printed.	No
Option 4: Retrofit impregnated cloth automatic blanket washers to the third press.	Automatic blanket washers have been successfully installed on sheetfed presses in other facilities on newly purchased equipment. According to the original equipment manufacturer, impregnated cloth washers are available for sheetfed presses and have been successfully retrofitted on similar presses in other facilities.	Yes

Option 5: Print product digitally	Digital printing limits the quality of the product that can be produced. Customer requirements will not allow for lower quality. Additionally, digital printing is much slower than litho printing and the product cannot be manufactured in the required time, given the short lead times.	No
Option 8: Install a solvent recycling unit on site	Vacuum distillation units are available in the marketplace. Printers has been successfully operating a solvent recovery systems for a number of years.	Yes

9.0 Assessment of Economic Feasibility

Those options that were determined to be technically feasible were assessed for economic feasibility as follows:

Option	Economic Feasibility	Feasible
Use 70% wash	A 70% VOC wash can be directly substituted for washes currently in use so no equipment modification is required. The cost of the wash is approximately 30% higher however. Assume the Autowash and UV REL can be replaced 1:1. **Cost savings -$17,973** **Payback 0 years**	No
Retrofit impregnated cloth washer to one press	Capital cost to install system is approx. $25,000 per unit Cost of consumables is approx. $90/roll, 300 per press per year Cost press wash $59,910 Cost waste $8,400 **Annual savings -$12,690** **Payback no payback**	No
Install solvent recycling unit	Cost of equipment is approx. $50,000 Cost savings wash 50% UV REL and 50% autowash with 80% recovery $23,964 Labour to run equipment 2hrs/day@45=$22,500 Utility cost $10,000 **Annual savings - $8,536** **Payback no payback**	No

10.0 Options that will be Implemented

There are no options that are technically or economically feasible and hence no options to implement.

11.0 Planner Recommendations

The planner has visited the site and worked with TI Group staff throughout the development of the plan. Data has been revised or added as necessary to improve the accuracy of the plan. Hence, there are no additional recommendations to improve the plan.

12.0 Certification

As of November 24, 2014, I, Bob Marcotte, certify that I have read the toxic substance reduction plan for VOCs and am familiar with its contents, and to my knowledge the plan is factually accurate and complies with the Toxics Reduction Act, 2009 and Ontario Regulation 455/09 (General) made under that Act.

Bob Marcotte, Plant Manager — Date

As of November 24, 2014, I, Wendy Nadan certify that I am familiar with the processes at TI Group that uses VOCs, that I agree with the estimates referred to in subparagraphs 7 iii, iv and v of subsection 4 (1) of the Toxics Reduction Act, 2009 that are set out in the plan dated November 30, 2012 and that the plan complies with that Act and Ontario Regulation 455/09 (General) made under that Act.

November 24, 2013

Wendy Nadan, Toxic Substance Reduction Planner — Date

TI group inc
integrated visual communications

As of June 1, 2015, I, Peter Spring, certify that I have read the toxic substance reduction plan for VOCs and am familiar with its contents, and to my knowledge the plan is factually accurate and complies with the Toxics Reduction Act, 2009 and Ontario Regulation 455/09 (General) made under that Act.

Peter Spring, President

June 1, 2015

Date