TOXIC SUBSTANCE REDUCTION PLAN

FOR

VACUUM METALLIZING LIMITED
30 DOVEDALE COURT
TORONTO, ON M1S 5A7

December, 2012

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A. *Master Document*

This is the **Master Document** for the following Toxic Substance Reduction Plan Reports for toxic substances used at the facility for which Toxic Substance Reduction Plans are required:

Plan No.	Substance Name	CAS No.
1	Xylene	1330-20-7
2	Heptane	142-82-5
3	Methyl ethyl ketone (MEK)	78-93-3
4	Methy isobutyl ketone (MIBK)	108-10-1
5	Mineral Spirits	Multiple

Much of the information required to be included in a Toxic Substance Reduction Plan (TSRP) is the same for each of the above substances because the subject solvents are all used in a similar way and are emitted from the same company processes. For this reason and to avoid unnecessary repetition, information common to each of the plans is included in this **Master Document** and is referenced by/in the TSRP for each substance. This master Document and the TSRP's for the above individual toxic substances comprise Vacuum Metallizing Limited's complete Toxic Substance reduction Plan.

1. *Facility Identification*

Owner:	
Name:	P&D Holdings Limited
Address:	2 Colvestone Road, Toronto, ON M2L 1X3
Occupant:	
Legal/Trade Name:	Vacuum Metallizing Limited
Address:	30 Dovedale Court, Toronto, ON M1S 5A7
Business Number:	105468771
NAICS Codes:	3328, 3399, 339900, 332810
SIC Code:	3479
Number of Full Time Employees	22
UTM Coordinates	641083, 4850698
NPRI ID:	0000007102
MOE ID:	ON0179901

2. *Contacts*

Public Contact, Technical Contact, Facility Coordinator, Highest-Ranking Employee and Person who Prepared This TSRP:

Name:	Jeffrey Sugar
Position:	President, Vcuuum Metallizing Limited

Address:	30 Dovedale Court, Toronto, ON M1S 5A7
Phone Number:	(416)754-3377 Extension 115
Fax Number:	(416)754-8077
Email:	jsugar@vacuummetallizing.ca

TSRP Planners:

Planner Making Recommendations:	Jeffrey Sugar, License #TSRP0253
Certifying Planner:	Kaleem Muhammad, License #TSRP0252

3. *Intention to Reduce Use of Toxic Substances and Objective of This TSRP:*

It is the intention of Vacuum Metallizing Limited to reduce the amount of toxic substances that it uses in the creation of its coatings and elsewhere in its manufacturing operation and specifically, those toxic substances that are the subject of this **Master Document** and associated TSRP's (i.e. TSRP's for xylene (CAS 30-20-7), heptanes (CAS 142-82-5), methyl ethyl ketone CAS 78-93-3, methy isobutyl ketone CAS 108-10-1, hydrotreated heavy naptha CAS 64742-48-9 and solvent naptha light aliphatic CAS 64742-89-8). At the present time the company is unable to quantify the amount of these reductions or when these reductions will be realized as explained in greater detail in this TSRP.

4. *Use of Toxic Substances*

Vacuum Metallizing Limited's business is the application of reflective and custom-painted finishes onto customer-supplied components.

Reflective films are produced by laminating a micro-thin layer of evaporated alloy between a painted basecoat and painted topcoat. Paints are either spray painted or flowcoated (washed) onto components being decorated. The company uses solvent-based paints in the creation of its coatings and the subject toxic substances are solvents received in paints as ingredients, added to paints as thinners or used to clean painting equipment before a paint change or line shutdown. All solvents used in the production process are released, disposed of, or recycled during and no solvents are created, transformed or destroyed in or as a result of the production process.

The company uses solvent-based paints as it believes that solvent-based coatings are best suited to its requirements. (See Section 7.1 *Solvent Reduction Options* for additional information on this subject.)

4.1 *Stages and Processes that Use the Subject Toxic Substances*

Identification and Description of Stages that Use the Subject Toxic Substances

The stages of Vacuum Metallizing Limited's manufacturing operation are depicted in Figure 1. This diagrams and accompanying descriptions were prepared in September, 2012 as part of the records produced during the accounting process.

The manufacturing operation at Vacuum Metallizing Limited consists of six stages, identified as Receiving, Preparation, Basecoating, , Metallizing, Topcoating, Packaging and Shipping.

Identification of Processes that Use Toxic Substances/Solvents

As noted the company's primary business is the application of reflective finishes on customer-supplied components and these finishes are producing these finishes involves the application of solvent-based painted films.

Small, symmetric components having an axis of rotation are decorated on spray rods (rotary spray process) while other asymmetric parts are decorated while affixed to metal frames/racks (flowcoating process). The steps in the production process are as follows:

- Parts mounted on frames may be pre-rinsed with solvent to remove surface lubricants.
- A basecoat paint is applied onto components to give them a smooth, glossy surface (necessary for obtaining reflectivity). Paint is applied either by spray or flowcoat process.
- The basecoat is cured in a convection oven.
- Aluminum is evaporated onto the surface of the basecoated parts in a vacuum chamber producing a mirror-like, reflective film.
- A topcoat paint is applied onto the components to protect and seal the aluminum layer using spray or flowcoat process.
- A soluble dye may be added to the topcoat paint to produce a tinted film (e.g. to simulate the appearance of brass or gold electroplating). Flowcoated parts may be immersed in a soluble dye to tint them.
- The topcoat is cured in a convection oven.
- Parts are unloaded, inspected and packaged.
- Finished goods are shipped.

The Solvent Receiving and Storage process begins when a subject solvent (xylene, heptane, methyl ethyl ketone, methy isobutyl ketone, hydrotreated heavy naptha or solvent naptha light aliphatic) arrives by truck at the facility and is transported to the storage area.

Solvent is moved to one of the flowcoaters to be used as a rinsing agent or as a paint thinner. Solvent contained in mixed paint is moved to spray booths or flowcoaters and is applied onto components. Coated parts are then moved into a convection oven where any remaining solvent in the coating is evaporated and exhausted to air. All but a small amount of solvent that is used is ultimately released to air through an exhaust stack either during the solvent rinsing process, during the paint application process, from uncured coatings on the surfaces of coated parts or from the curing ovens. Some amount of solvent present in paint sludge, paint arrestor filters and cleanup cloths is disposed of along with the host waste.

The Vacuum Metallizing Limited's manufacturing processes are depicted in Figure 1 and Figure 2 provides a visual illustration of the company's manufacturing system (i.e. how the

company produces its coatings and how work flows through the facility). Those processes that use the toxic substances are identified.

5. *Tracking of Toxic Substances at the Process Level*

This section identifies for each of the Vacuum Metallizing Limited's processes:

- How the substance enters the process
- Whether the substance is created, destroyed or transformed during the process
- How the substance leaves the process and what happens to it after it leaves the process

Process Flow Diagrams

A process flow diagram is provided for each process to graphically illustrate the process and the movement of the toxic substance through it.

The following Legend provides the meaning of the notations on the process flow diagrams and applies to all of the diagrams in this Master Document and in the TSRP for each toxic substance:

Legend			
Presence of toxic substance		**DQL**:	Data Quality Level =
U:	Toxic substance enters the process (Use)	**H**	"High"
A:	On-site release of toxic substance to Air	**AA**	"Above Average"
Dis	On-site or off-site disposal of toxic substance	**A**	"Average"
Int:	Intermediate step to describe movement of unchanged toxic substance	**U**	"Uncertain"
Rec:	On-site recycling of toxic substance for reuse		

Receiving Stage – SOLVENT RECEIVING AND STORAGE PROCESS

The Paint/Solvent Receiving and Storage Process is depicted in Table 3. It begins when a solvent arrives by truck at the facility in sealed 205 litre (45 imp. gallon) steel or plastic drums. A drum will contain only solvent (for use as paint thinner) or will contain paint (containing the solvent as a formulation ingredient).

If the drums containing the substance arrive on pallets (as is often the case for received paints), the skid/drums are transported by forklift to the entrance to the Paint Storage room, which is located at the opposite end of the Facility. There the drums are taken off the pallets and moved individually into the paint storage room using a hand dolly.

If the drums are transported individually and not on skids, they are moved individually from the shipping dock and into the Paint Storage room using the hand dolly.

If there is room on the dispensing rack and there will be a need to tap into the drum in the near future, a ball valve is connected to the larger bung hole in the top of the drum, the

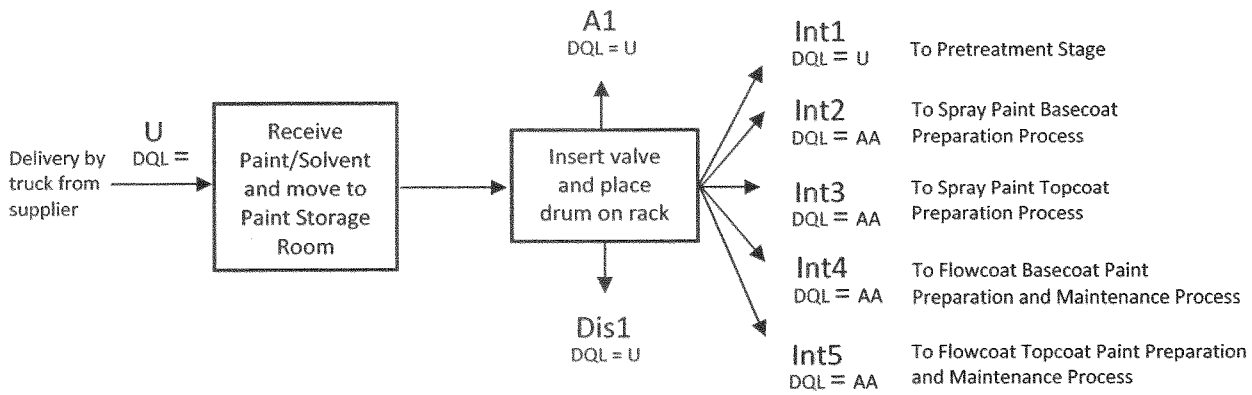
drum is tipped onto its side and lowered to the floor and using a hydraulic lift it is lifted and placed in position on a dispensing rack. If the contents of the drum will not be needed in the immediate future or there is no room for the drum on the dispensing rack, the drum may be left standing upright on the floor of the Paint Storage Room or may be tipped onto its side and stored lying on its side beneath the dispensing racks. Drums stored on the floor may be moved onto the dispensing racks using the hydraulic lift when they are required or to make space on the floor.

Potential sources of release to air/disposal of solvents during this process:

- Release to air when solvent/paint leaks onto the floor from ball valve that is improperly fitted of not fully closed
- Release to air when solvent evaporates from rags used to mop up aforementioned spill
- Disposal when rags used to clean up a spill are disposed of.

Spray painting and flowcoating department supervisors advise that the above-described potential sources release only a negligible amount of solvent is released in any year because drums are open for less than one minute during valve insertion and a leakage/spill of paint rarely occurs and involves only a very small volumes of paint.

Figure 1: Process Flow Diagram for Solvent in Paint/Solvent Receiving and Storage Process



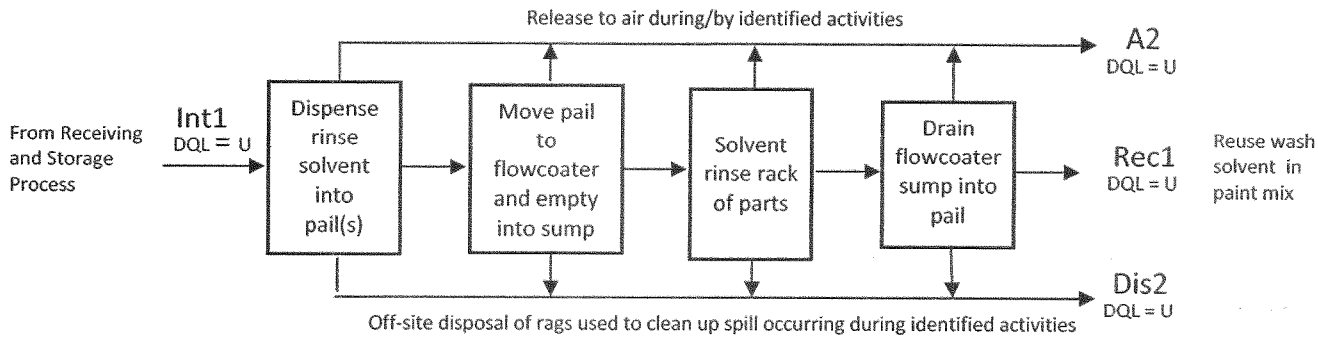
Preparation Stage – PRETREATMENT PROCESS

The Prparation Stage Pretreatment Process is depicted in Table 4. On occasion components arrive with surface lubricants that must be removed before the parts are decorated and this may be accomplished by rinsing them with solvent in a flowcoater. Solvent is dispensed into a 18.9 litre pail in the Paint Storage Room or from the Thinner Drum (See , transported to the flowcoater and poured into the flowcoater sump. The Flowcoating Process description (below) also applies to this process except that solvent, rather than mixed paint, is used and washed over the parts.

Sources of release to air/disposal of solvents during this process:

- Release to air when solvent is dispensed and transported in open pails
- Release to air when solvent is poured from the pail into the flowcoater sump and/or returned from sump into pails
- Release to air from solvent flowing from the flowcoater wash tank onto parts during rinsing process
- Release to air from solvent evaporating from surfaces of washed parts
- Release to air due to evaporation of solvents from surface of solvent in paint sump
- Release to air when solvent is spilled onto the floor during the above-mentioned activities
- Release to air from rags are used to clean up a spill
- Disposal along with rags used to clean up a spill

Figure 2: Process Flow Diagram for Solvent Rinsing in Pretreatment Process



Basecoat/Topcoat Stage – SPRAY PAINT PREPARATION PROCESS

The Spray Paint Preparation Process is depicted in Table 5 and applies to the blending and preparation of both basecoat and topcoat paints for application by spray painting.

An 18.9 litre (5 U.S. gallon) pail is placed on the floor beneath the drum (if the drum is on the bottom shelf of the dispensing rack) or is hung by the handle from the ball valve (if the drum is not on the bottom shelf).

The required amount of paint or solvent is dispensed into the pail using the ball valve. If/when an additional formulation ingredient is required, the partially-filled pail is moved to the drum containing the required solvent/paint ingredient and the ingredient is dispensed in the same way. When all ingredients have been dispensed, the ingredients are stirred with a stick to blend them. The wet stick is placed into an open pail. The pail of mixed paint is moved to the spray booth work station by hand or a dolly designed for this purpose may be used.

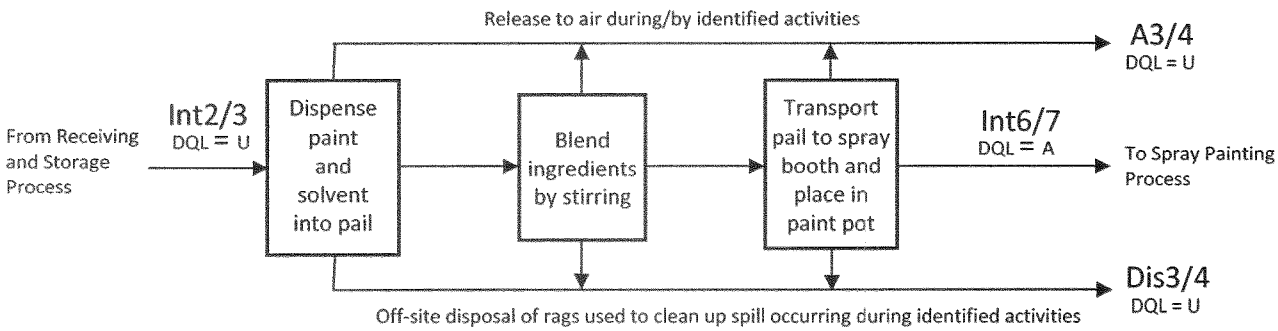
At the spray booth, the lid is removed from the paint pot, the pail of paint is placed into the pot and the lid of the pot is replaced and sealed. If the spray system is pneumatic, the air

regulator may be adjusted to provide the target air pressure and the air valve is opened; if the spray system is mechanical, the pump pressure may be adjusted and the pump is turned on.

Sources of release to air/disposal of solvents during this process:

- Release to air when paints and/or thinners are dispensed, blended, and transported in open pails
- Release to air when paint or solvent is spilled onto the floor during the above-mentioned activities
- Release to air from rags are used to clean up a spill
- Disposal along with rags used to clean up a spill

Figure 3: Process Flow Diagram for Spray Paint Basecoat/Topcoat Preparation Process



Basecoat/Topcoat Stage – FLOWCOAT PAINT PREPARATION PROCESS

The Flowcoat Paint Preparation Process is depicted in Table 6 and applies to the blending and specific gravity/viscosity maintenance of both basecoat and topcoat paints for application by flowcoating.

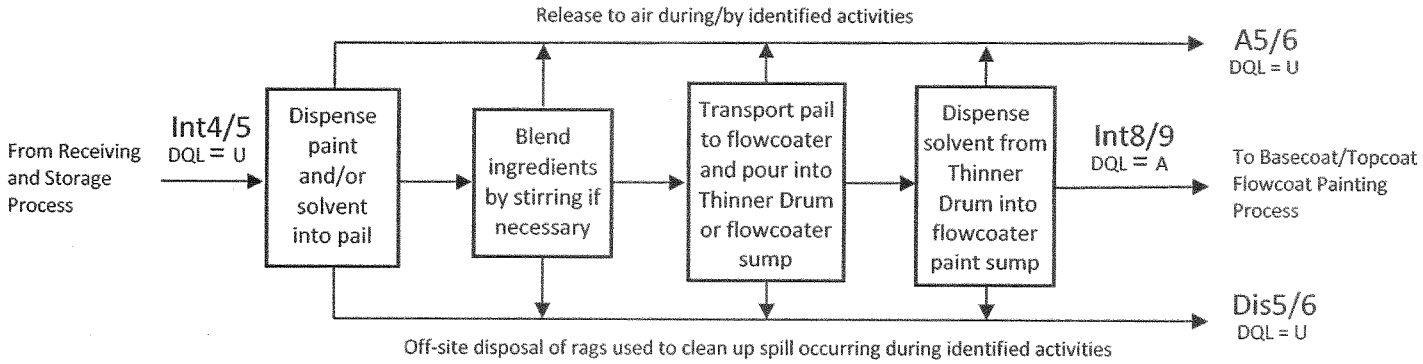
If the required paint mix is not already present in the flowcoater sump, the paint mix is blended in pails in the Paint Storage Room (as described in the Spray Paint Preparation Process, above), transported to the flowcoater by hand or using the dolly and poured from the pails into the flowcoater sump. The flowcoater circulating pump is turned on and thinner is added to the paint mix until the target specific gravity/viscosity is measured.

In the case of alkyd paint, paint thinner is maintained in and dispensed directly from a 205 liter (45 imp. gallon) drum having a removable lid and which is kept beside the flowcoater (the "thinner drum"). Thinner for polyurethane paints is decanted into a pail in the Paint Storage Room, carried to the flowcoater and decanted from the pail into the flowcoater sump.

Sources of release to air/disposal of solvents during this process:

- All sources listed under the Spray Paint Blending Process
- Released to air when paint or solvent is poured into the flowcoater paint sump
- Release to air when thinner is discharged from the thinner drum into the flowcoater paint sump
- Release to air due to evaporation of solvents from surface of paint in paint sump
- Release to air from the paint wash dropping from the flowcoater wash tank

Figure 4: Process Flow Diagram for Flowcoat Paint Basecoat/Topcoat Preparation Process



Basecoat/Topcoat Stage – SPRAY PAINTING PROCESS

The Spray Painting Process is depicted in Table 7 and applies to the application of both basecoats and topcoats using the spray painting system.

Parts to be painted are mounted on spray rods equipped with spindles that allow parts mounted on the spray rods to be rotated. The spray rods are carried on and moved through the production process on carts. A reciprocating painting machine is situated in the opening of the spray booth. The operator removes a spray rod from the source cart and places the spray rod in a holding fixture that is mounted on the reciprocating painting machine. The parts are caused to rotate and two spray guns are moved along the length of the spray rod applying paint onto the spinning parts. When the painting cycle has ended, the processed spray rod is removed from the holder and placed on the receiving cart. When all spray rods on the source cart have been processed the receiving cart is moved to the appropriate convection oven.

Four spray booths are water-wash type booths equipped with pneumatic spray equipment employing automatic HVHP (high volume high pressure) spray guns; two are water-wash type booths equipped with a LVHP mechanical (pump) spray systems and one booth is a dry-filter type booth in which LVHP and HVHP manual spray guns are used.

Periodic maintenance is required to remove paint buildup from the spray booth and reciprocating painting machines. In the case of the water-wash booths, floating paint solids are skimmed from the wash tanks each morning and collected. When a water-wash booth is cleaned, the water in the booth is aerated prior to draining the wash tanks to allow solvents in the water to evaporate. Water is then drained into the sanitary sewer and paint

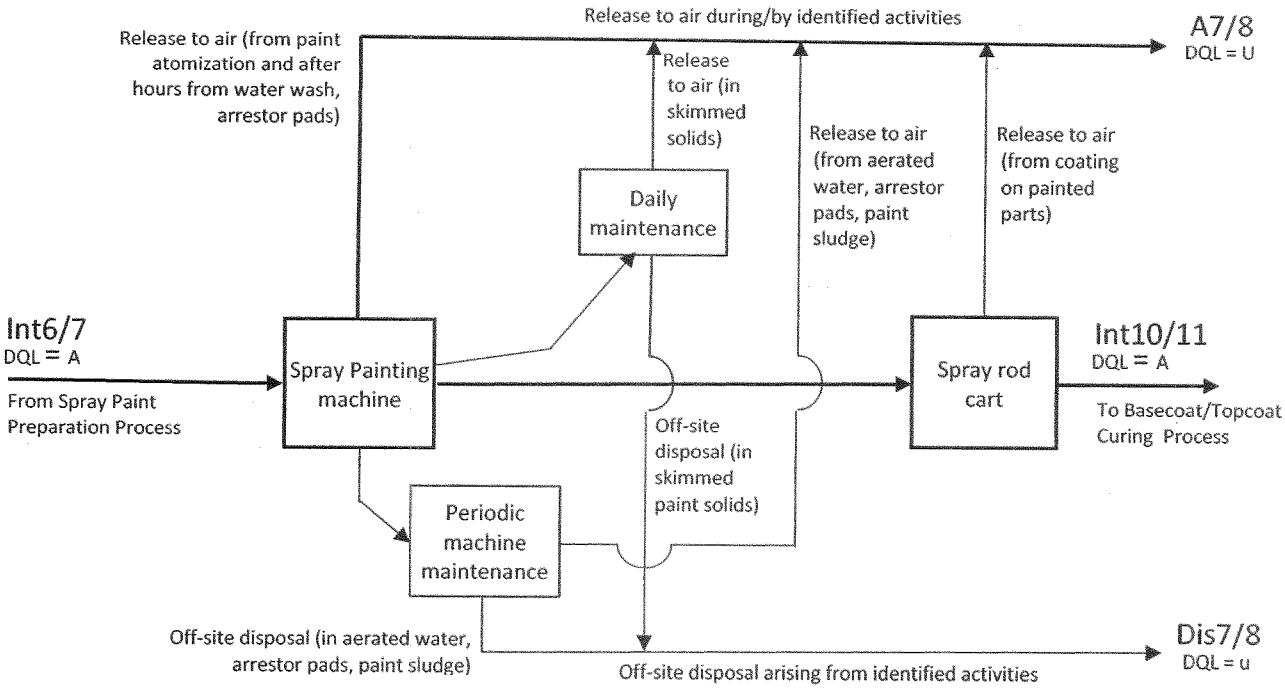
solids are removed from the bottom of the water tank, from surfaces of the spray booth and the reciprocating painting machine.

The spray guns and paint pot in each spray booth must be cleaned before every paint change and at the end of each business day and this accounts for a significant portion of mineral spirits usage.

Sources of release to air/disposal of solvents during this process:

- Release to air from cloud of atomized/sprayed paint delivered by spray guns
- Release to air from uncured paint on coated parts
- Release to air during circulation and aeration of water wash during normal production and overnight (water-wash-type booths)
- Release to air from uncured paint trapped by arrestor pads as air is drawn through the pads during normal production and overnight (dry filter-type booth)
- Release to air when paint lines and spray guns are flushed/rinsed prior to paint change or shutdown
- Release to air from uncured paint solids skimmed from surface of water tank during daily maintenance (water wash-type booth)
- Disposal along with skimmed, uncured paint solids (water wash-type booth)
- Release when water wash is aerated prior to draining water tank when periodic maintenance is conducted (water wash-type booth)
- Disposal/Release when water containing residual solvent is drained into sanitary sewer when periodic maintenance is conducted (water wash-type booth)
- Release to air from uncured paint solids removed from bottom of drained water tank when periodic maintenance is conducted (water wash-type booth)
- Disposal along with uncured paint solids removed from bottom of booth (water wash-type booth)
- Release to air from uncured paint in spent paint arrestor pads when pads are removed and disposed of periodic maintenance is conducted (dry filter-type booth)
- Disposal along with disposal of spent arrestor pads.

Figure 5: Process Flow Diagram for Basecoat/Topcoat Spray Painting Process



Basecoat/Topcoat Stage – FLOWCOATING PROCESS

The Flowcoating Process is depicted in Table 8 and applies to the application of both basecoats and topcoats using the flowcoating system.

Parts to be coated are affixed to welded racks and the racks are moved through the production process on carts. Racks to be painted are removed from the cart(s) and mounted on the flowcoater conveyor in the flowcoater intake/outlet opening. The conveyer causes mounted racks to be rotated while moving them in a circuit through a paint wash, into a plenum at the top of the machine where heat from a direct-fired gas burner partially cures the paint and then back to the intake/outlet opening where the racks are removed from the conveyor and returned to the cart(s). When a cart has been filled (or when the last of the racks has been processed) it is moved to an appropriate convection oven.

A paint which is used regularly may be maintained in the flowcoater sump for prolonged periods. However, the flowcoater sump must be drained and rinsed if it is expected that the paint will not be needed in the near future, before a plant shutdown or when periodic maintenance is required to remove paint buildup from surfaces of the machine. In this event the paint is pumped into pails which are moved by hand or by dolly for storage in the Paint Storage Room. The flowcoater paint delivery system is then rinsed by dispensing wash

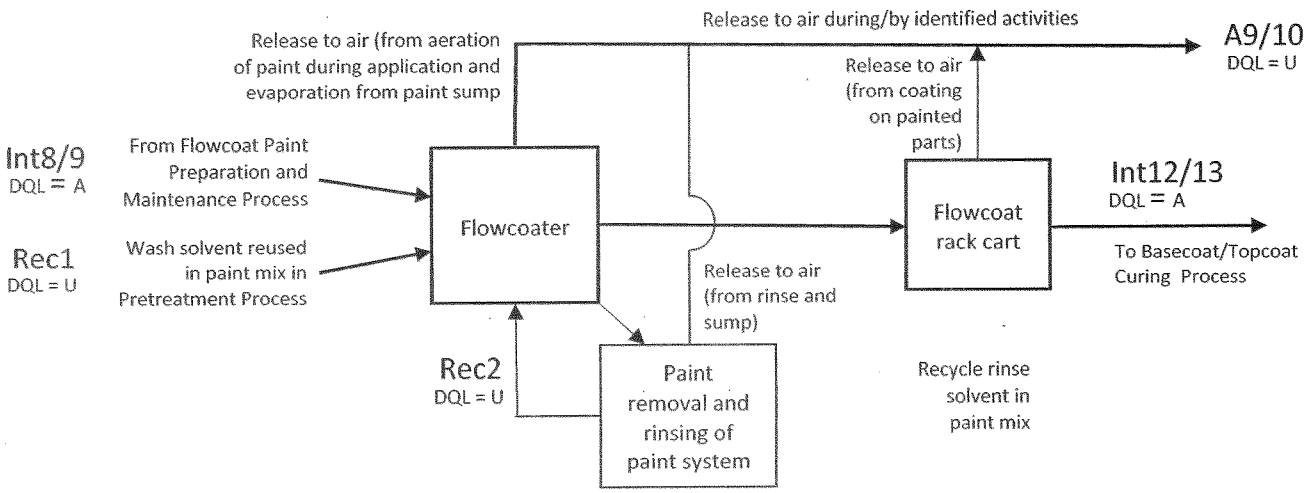
solvent, pouring the solvent into the flowcoater sump and circulated the solvent for several minutes. Used wash solvent is recycled/reused as a paint ingredient/thinner.

Dried paint is scraped by hand from the surfaces of the flowcoater and discarded as waste.

Sources of release to air/disposal of solvents during this process:

- Release to air when thinner is discharged from the thinner drum into the flowcoater paint sump to maintain the specific gravity of the paint
- Release to air due to evaporation of solvents from surface of paint in paint sump
- Release to air from paint dropping from the flowcoater wash tank
- Release to air from uncured paint on coated parts
- Release to air when paint is pumped from the flowcoater sump into pails for storage
- Release to air when rinse solvent is pumped from the flowcoater sump into pails for reuse/recycling

Figure 6: Process Flow Diagram for Basecoat/Topcoat Flowcoating Process



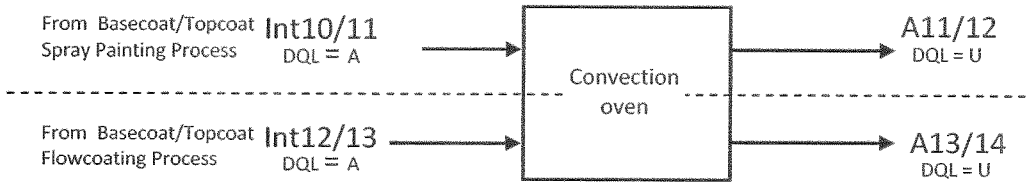
Basecoat/Topcoat Stage – CURING PROCESS

Carts carrying painted parts are moved into a convection oven. The baking temperature and duration is specified on the process sheet and are determined by the substrate material of the parts and the type of coating applied.

Sources of release to air/disposal of solvents during this process:

- Release to air from uncured paint on parts being transported from painting machine to curing oven
- Release to air from paint being cured in oven

Figure 7: Process Flow Diagram for Spray Paint and Flowcoat Paint Basecoat/Topcoat Curing Process



6. *Tracking and Quantification of Toxic Substances at the Process Level*

(i) Sources are used to track, quantify and account for the use of toxic substances

The following sources are used to track, quantify and account for the use of toxic substances:

Raw Materials:

Sources of cost data: Purchase records for paints and solvents, supplier invoices, year-end inventory records, MSDS, ECA

- Chemical information: MSDS, ECA , Supplier-supplied paint ingredient lists

Production:

Sources of cost data: Daily and monthly production reports, ECA, NPRI, engineering estimates

- Paint formulations: Production records, ECA, NPRI \Production rates: Daily machine production records, ECA (1 spray load per hour, 3.2 flowcoater loads per hour)
- Paint yields: ECA, engineering estimates
- Distribution of production according to paint type: Daily production records, monthly production summary
- Proportion of solvent emitted during the spraying process vs. emitted in the convection oven: Engineering estimate 80%/20%.
- Mass of solvent emitted or disposed of from each process: "Best guess" engineering estimates
- Frequency of paint spills and washing of paint lines and associated material volumes: "Best guess" by departmental supervisors

Process Related Utilities:

Source of cost data: Electricity and water utility bills

Labour:

Source of cost data: Payroll records

- Labour wage and working hour data

(ii) Data Quality

To improve data quality the company has started to record the amount and destination/use of paint and solvent drawn from inventory for all purposes. This information will be available for the TSRP update due in 2014. In addition, beginning in January, 2013, the same inventory system will be used to determining solvent usage/emissions for the purposes of NPRI reporting (which has been based only on purchases) and TSRP reporting (with its greater concern with usages).

(iii) Calculating Solvent Usage

The following assumptions are used in al TSRP plans and are used based on the "best guess" advice of the painting department managers:

1. The amount of paint or solvent that leaks onto the floor during the dispensing process is an insignificant volume relative to total usage.
2. In the spray department, mixed paint is spilled from a carried pail one time for each week worked; an average of one litre of paint is spilled on each occasion and the proportion of spills that involve a particular paint mix (relative to the total number of spills) is the same proportion as the usage volume of that paint mix (relative to the total volume of all paint mix used).
3. In the flowcoating department, one spill occurs each week from a carried pail; an average of one litre is spilled on each occasion; two-thirds of the spills involve mixed paint and one quarter of the spills involve thinner solvent and the proportion of spills involving a particular paint mix/solvent (relative to the total number of spills) is the same proportion as the usage volume of that paint mix/solvent (relative to the total volume of all paint mix/solvent used.

It is assumed that spills are allocated only to paints that are dispensed in pails and distributed according to the volume of each paint mix that was used in 2011. Annual volume paint usages, associated production data and paint mix distribution factors are presented in Table A1 and are calculated as follows:

Annual Usage = (volume of paint mix used per load) x (#loads processed with pant mix)

Distribution factor = (annual usage of paint mix) ÷ (sum of annual usages of all paint mixes)

The quantification of solvent used, released to air or disposed for a specified toxic substance can be found in the individual TSRP for that substance.

FACILTY-WIDE ACCOUNTING

A facility-wide accounting for all substances subject to this TSRP is presented in Table A4. From this table we note that the Spray Painting Topcoat Process accounts for the highest proportion of toxic substance use at 38.6%, followed by the Spray Painting Basecoat Process at 27.6%, the Spray Painting Topcoat Curing Process at 9.7% and the Spray Painting Basecoat Curing Process at 9.3%. All other processes collectively account for the remaining 14.8%.

7. *Opportunities for Reducing the Use of Toxic Substances*

Vacuum Metallizing Limited looked at why, how, and how often its uses toxic substances in each of its six production processes and how these substances enter and exit each of the processes with a view to finding toxic substance reduction options. Looking at each of the six processes, all possible reduction strategies corresponding to the following seven toxic substance reduction options were considered:

- Material or feedstock substitution
- Product design or reformulation
- Equipment or process modification
- Spill and leak prevention
- Onsite reuse or recycling
- Improved inventory management or purchasing techniques
- Training or improved operating practices

We conclude from the facilty-wide accounting for all toxic substances that the most effective toxic reduction strategy will reduce the use of solvents in all processes, and if that is not possible or as a secondary goal, will focus on spray painting, which accounts for more than 85% of the total usage and within that category, on the Spray Painting Topcoat Process.

7.1 Toxic Reduction Options

A number of toxic reduction options were identified and a technical evaluation of each was conducted. The following are the options that were identified and considered and these are referenced by each of the five TSRP's as appropriate. The order of presentation reflects the priority given to each option in terms of the options' perceived relative effectiveness in terms of its potential for solvent reduction. (For example, an option that would have the effect of reducing the use of multiple solvents in multiple processes was given a higher ranking than one which would reduce the use of only one solvent, affect only one process, or only produce a minimal amount of reduction.)

The following are the options that were considered and the results of associated technical and (for technically feasible options) economic evaluations:

a) Option: Replace solvent-based paints with water-based or water-borne paint systems.

Option Category:	Product design or reformulation Equipment or process modification Material or feedstock substitution
Scope:	All toxic substances used at the facility
Technical Evaluation:	Option is not technically or economically feasible
Explanation:	

- Unable to produce coatings of acceptable quality using a water-based or water-borne basecoat.
- Resulting films tend to "blush" and have excessive "peel".
- Use of these paints to produce topcoats restricted due to the unavailability of soluble dyes for tinting.
- Flowcoating these materials is difficult if not impossible due to their high surface tension.
- Even if materials could be flowcoated, replacement equipment would need to be designed, tested and installed.
- Capital cost associated with replacing or converting flowcoating equipment cannot be justified based on sales levels.

b) Option: Replace wet-painted topcoats with powder-coated topcoats.

Option Category:	Product design or reformulation Equipment or process modification
Scope:	All toxic substances used at the facility
Technical Evaluation:	Option is not technically feasible
Economic Evaluation:	Option is not economically feasible for remainder of work
Explanation:	- Most substrates sent for coating will melt at temperatures required for powder coating. - Cannot reproduce the mirror-like finish using a powder coated basecoat. - Tooling used for flowcoating would need to be replaced and/or parts would need to be moved back and forth between powder coating racks and flowcoating racks adding to unit cost. - Powders for producing tinted, translucent coatings are not available and would have to be custom-manufactured with minimum order requirement for each colour match. - Company hasn't the financial resources to make the required up-front investment in equipment and powder and then seek customers interested in its new coatings. Customers will not commit to ordering unless process exists and is operating.

c) Option: Replace toxic substance with non-voc replacement solvent.

Option Category:	Product design or reformulation
Scope:	All or some of the toxic substances used at the facility
Technical Evaluation:	Option may be technically feasible for some toxic substances but validation will be required
Economic Evaluation:	Refer to TSRP for subject substances
Explanation:	A number of companies are now marketing non-voc solvents to

replace solvents such as xylene, MIBK, MEK and mineral spirits. Company has considered using these materials and has obtained prices that are several times the price of the materials these would replace. Company does not believe price increases can be passed through to customers or absorbed because it is experiencing pricing and financial pressures and is losing sales to lower-cost Asian suppliers and alternative coating services employing silver-reduction.

- Replacement solvents would also need to be compatible with the flowcoating process which is highly-sensitive to solvent density and surface tension. If paints having ingredient replacement solvents can be sprayed but not flowcoated using existing equipment, Company will need to increase the size of its solvent inventory. Finding room to house this additional inventory and the associated investment of working capital would be a problem for the company.
- Company will continue to monitor prices for non-voc replacement solvents and thoroughly test their use if and when these become more competitively priced compared to conventional solvents.

d) Option: Replace HVHP spray guns with more efficient LVLP or LVHP spray guns.

Option Category:	Equipment or process modification
Scope:	All toxic substances used at the facility
Technical Evaluation:	A complete technical and economic evaluation of the opportunity has not been completed at this time
Economic Evaluation:	Not available at this time
Explanation:	- LVLP and LVHP spray guns are designed for most applications which involve the spraying of opaque, high-solid coatings. - Past testing of this equipment indicated that - at the low level of solids used in the process - paint consumption may in fact increase. - Inability to produce a tinted, translucent coating having sufficiently-uniform pigment distribution for application over a mirror-like aluminum film in many applications. - Inability to produce basecoat coatings with zero "peel" to go under mirror-like aluminum film in most applications.
Note:	Company has not tested the latest generation of equipment. Plans to conduct tests in 2013, a technical or economic evaluation of this option cannot be provided before December 31, 2012. This will be

included in the June 1st TSRP update if an economic analysis is completed by that time.

e) Option: Apply paints at higher solids levels

Option Category:	Product design or reformulation Equipment or process modification
Scope:	All toxic substances used at the facility
Technical Evaluation:	Option is not technically feasible
Explanation:	- Basecoats applied at higher solids levels are insufficiently smooth for use under mirror-like evaporated film. - Pigmented, translucent coatings produced at higher solids level may have inconsistent pigment dispersion.

f) Option: Apply thinner films

Option Category:	Product design or reformulation Equipment or process modification Training or improved operating practices
Scope:	All toxic substances used at the facility
Technical Evaluation:	Option is not technically feasible
Explanation:	- Basecoats are being applied at the minimum film thickness required to hide or fill in substrate surface texture. - Topcoats are being applied at the minimum thickness required to avoid light refraction (rainbow effect in topcoat film).

g) Option: Reduce overspray by narrowing spray patterns/fans

Option Category:	Equipment or process modification Training or improved operating practices
Scope:	All toxic substances used at the facility
Technical Evaluation:	Option is not technically feasible
Explanation:	- Narrowing spray patterns will produce basecoats with unacceptable "peel". - Narrowing spray patterns will produce topcoats with unacceptable pigment distribution.

h) Option: Reduce flowcoater ventilation to lower rate of solvent evaporation from sump

Option Category:	Equipment or process modification
Scope:	All toxic substances used at the facility except for MIBK

Technical Evaluation:	Option is not technically feasible.
Explanation:	Evacuation of solvents from flowcoater is necessary to produce painted films of acceptable quality and prevent risk of fire or explosion.

i) Option: Recapture, recycle offsite and re-use solvents used to rinse spray guns and paint lines

Option Category:	Onsite reuse or recycling Training or improved operating practices
Scope:	Mineral spirits only
Technical Evaluation:	Option is technically feasible
Economic Evaluation:	Refer to TSRP (F) - mineral spirits for details
Explanation:	Solvent used to rinse spray guns and paint lines is currently being directed into spray booth water wash. If it were to be directed into a container it could be sent to an off-site recycler who would process it and resell the processed material back to the company for reuse.

j) Option: Recapture and reuse solvents used to rinse spray guns and paint lines

Option Category:	Onsite reuse or recycling Training or improved operating practices
Scope:	All toxic substances used at the facility
Technical Evaluation:	Option is technically feasible
Economic Evaluation:	Refer to TSRP (F) - mineral spirits for details
Explanation:	Solvent used to rinse spray guns and paint lines is currently being directed into spray booth water wash. Through testing, its has been determined that If the wash were to be directed into a container the majority of its volume can be reused for this same purpose.

k) Option: Pipe paints and/or solvents to painting machines instead of carrying pails of paint

Option Category:	Spill or leak prevention Equipment or process modification
Scope:	All toxic substances used at the facility
Technical Evaluation:	Option is technically feasible
Economic Evaluation:	
Estimated capital cost for required equipment	$375,000

Estimated annual associated increase in costs:	
Equipment maintenance:	4,000
Cost of replacing production due to wrong paints sent to workstation	25,000
Employee training:	1,000
Operation of paint kitchen - 1 hr per day @ $20	9,600
Savings:	
Spilled paint 49 litres	(400)
Carrying pails of paint to workstations and fill Paint pots/sump 5 machines x 2 trips/day x 2 minutes per trip x $20.00/hr.	(1,600)
Net cost increase/(decrease)	$37,600

Implementation of option would require large capital investment and result in a significant increase in costs.

Conclusion: Option is not economically feasible

Explanation: Paints used in painting machines varies constantly dipensing on the type of work and available work volume. Although it may be technically feasible to pipe paint and/or solvent to any one of 11 spray painting machines, the logistics will be complicated, the equipment and infrastructure will be expensive and savings (in terms of solvent reduction) would be no more than 49 kg per year. The cost of maintaining the system would exceed any labour cost savings, particularly considering the time that employees would expend in operating the dispensing system.

l) Option: Purchase paints and solvents in smaller quantities

Option Category: Improved inventory management or purchasing techniques
Technical Evaluation: Option is technically feasible for purchases of some paints but not for most materials.

Scope: All or some of the toxic substances used at the facility

Economic Evaluation: Refer to TSRP for subject substances

Explanation:
- Solvent inventories are already minimized as solvents are ordered weekly only as required
- Reducing the quantity of paint maintained in inventory will increase the frequency of ordering for resupply
- Paint purchases are subject to supplier minimum order requirements and significant delivery costs (because they are imported from the United States).

- Paints are unique and made to order. A supplier - who orders raw materials for the paint only after an order for the paint has been - may not be able to obtain raw materials on short order.
- Company requires a buffer paint inventory to allow for such delivery delays.

m) Option: Dispense and transport paints in sealed containers

Option Category: Spill and leak prevention
Equipment or process modification
Training or improved operating practices

Scope: All or some of the toxic substances used at the facility

Technical Evaluation: Option is technically feasible

Economic Evaluation:

Capital cost:	25 containers @ $100 ea		$2,500
Savings:	49 litres spilled paint	($ 400)	
Associated cost increases:			
	Additional time to dispense into sealed Containers or to seal and unseal lid 5 machines x 2 dispensings per day ea. X 5 minutes ea. @ $20.00/hr.	4,000	
	Cleaning and maintenance of containers 5 minutes per month per container @ $15/hr	375	
Net cost increase/(decrease)			$3,975

Implementation of option would require large capital investment and result in a significant increase in costs.

Conclusion: Option is not economically feasible.

Explanation:

- Existing practice is to dispense paint/solvent into open-top 20 USG (18.9 litre) paint pails and trasport these to the workstation by hand or using a hand dolly.
- Pails are free in that they originally contained paint and they are discarded and replaced when they become damaged, rusty or contaminated.
- Despite the fact that pails are unsealed when transported 1) spills rarely occur, 2) spill amounts are insignificant at only 49 kg. per year and 3) solvent evaporation from the pails is insignificant as pails are filled and open only for minutes at a time.
- Sealing paint pails with original lids and reopening them is time consuming and increases the likelihood of spills

- Use of specialty sealed, containers would make dispensing paints more difficult and time consuming, add to maintenance costs (cost to buy pails, clean them and repair them) and not produce any significant reduction in solvent usage.

8. *Analysis of Costs Associated With Use of Toxic Substances*

The following is a summary of the above options as pertaining to the five toxic substances used at the facility. As noted, economic evaluation of the options as pertaining to a toxic substance can be found in the TSRP for that substance.

OPTION	Technically Feasible?	Able to Evaluate Now?	Economic Analysis Required?	Economically Feasible?
(a)	NO	N/A	NO	N/A
(b)	NO	N/A	NO	N/A
(c)	MAYBE	YES	YES	NO
(d)	MAYBE	NO	NO	MAYBE
(e)	NO	N/A	NO	N/A
(f)	NO	N/A	NO	N/A
(g)	NO	N/A	NO	N/A
(h)	NO	N/A	NO	N/A
(i)	YES	YES	YES	NO
(j)	YES	YES	YES	YES
(k)	YES	YES	YES	NO
(l)	YES	YES	YES	NO
(m)	YES	YES	YES	NO

Options requiring economic analysis are (c), (i), (j), (k), (l), (m). Options (k) and (m) are assessed in this Master Plan as they are common to all toxic substances used at the facility. The other options are addressed in the individual TSRP's as appropriate.

9. *Implementation of Opportunities for Reducing the Use of Toxic Substances*

Vacuum Metallizing Limited plans to implement Option (i) *"Recapture, recycle offsite and re-use solvents used to rinse spray guns and paint lines"* and Option (j) *"Recapture and reuse solvents used to rinse spray guns and paint lines"*, above. See TSRP F – mineral spirits for details.

The company does not plan to implement any of the other identified options at this time because none was found to be both technically and economically feasible for reasons presented above.

New spray equipment will be evaluated and the prices of replacement solvents will continue to be monitored in pursuit of addition opportunities for toxic substance reduction.

10. Certifications

Certification by Toxic Reduction Planner:

As of Dec. 18, 2012, I Kaleem Muhammad certify that I am familiar with the processes at Vacuum Metallizing Limited that use or create the toxic substances xylene, heptane, methyl ethyl ketone, methy isobutyl ketone and mineral spirits, that I agree with the estimates referred to in subparagraphs 7 iii, iv and v of subsection 4(l) of the *Toxics Reduction Act, 2009* that are set out in the plans for the aforesaid substances dated December 15, 2012 and that the plans comply with the act and Ontario Regulation 455/09 (General) made under that Act.

Kaleem Muhammad License #TSRP0252

Certification by highest-ranking employee of the facility having management responsibilities relating to the facility:

I, Jeffrey Sugar, certify that during 2012, a review of the toxic substance reduction plans for xylene, heptane, methyl ethyl ketone, methy isobutyl ketone and mineral spirits was conducted in accordance with the *Toxics Reduction Act, 2009* and Ontario Regulation 455/09 (General) made under that Act. As of December 15, 2012, I also certify that I have read the toxic substance reduction plans dated December 15, 2012 for the aforesaid substances and am familiar with their contents and to my knowledge these versions of the plans are factually accurate and comply with the *Toxics Reduction Act, 2009* and Ontario Regulation 455/09.

Jeffrey Sugar, President
Vacuum Metallizing Limited

FIGURE 1

VACUUM METALLIZING LIMITED
STAGES AND PROCESSES
(Describing use of all six toxic substances in TRSP's referencing this Master Document)

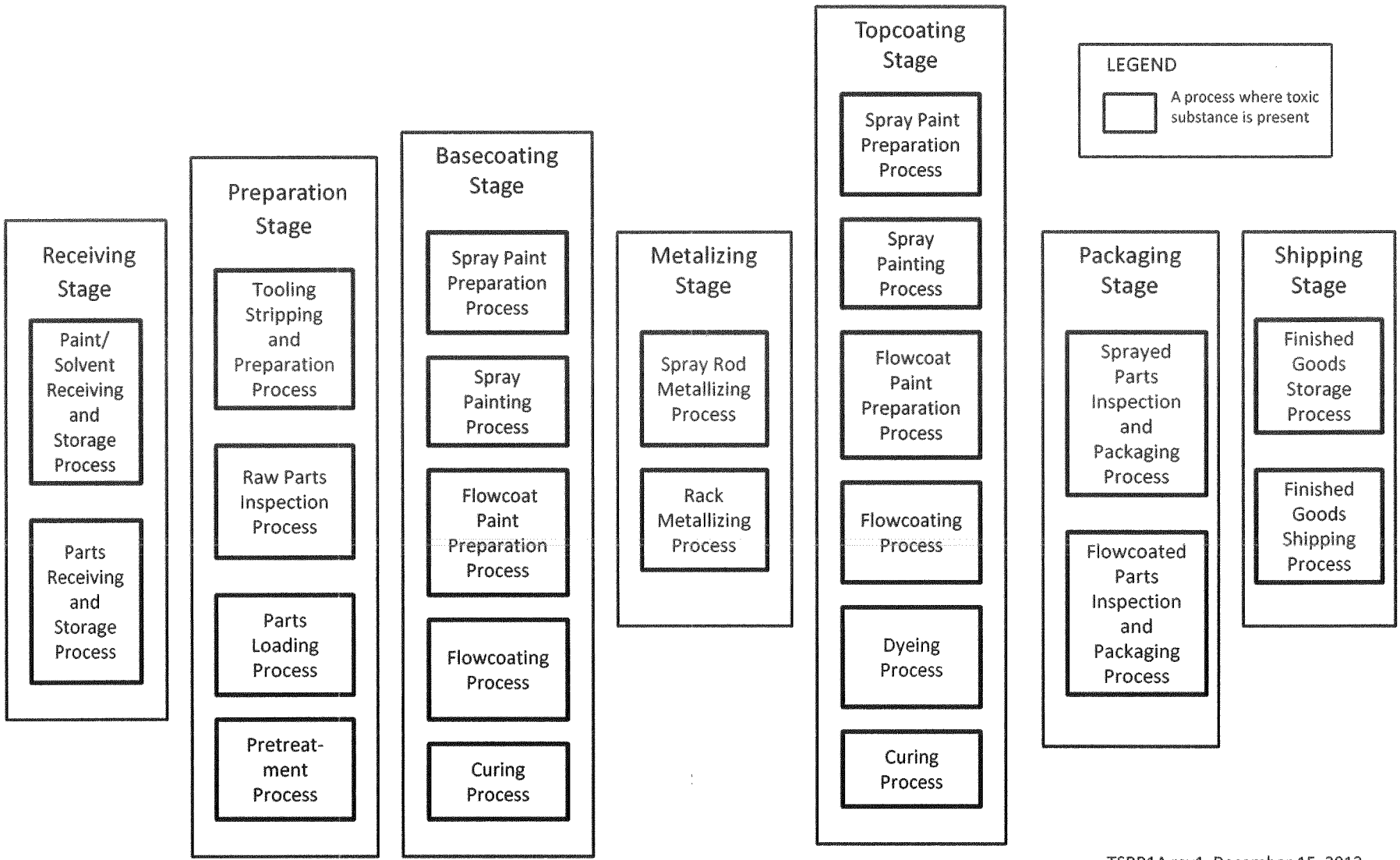


FIGURE 2

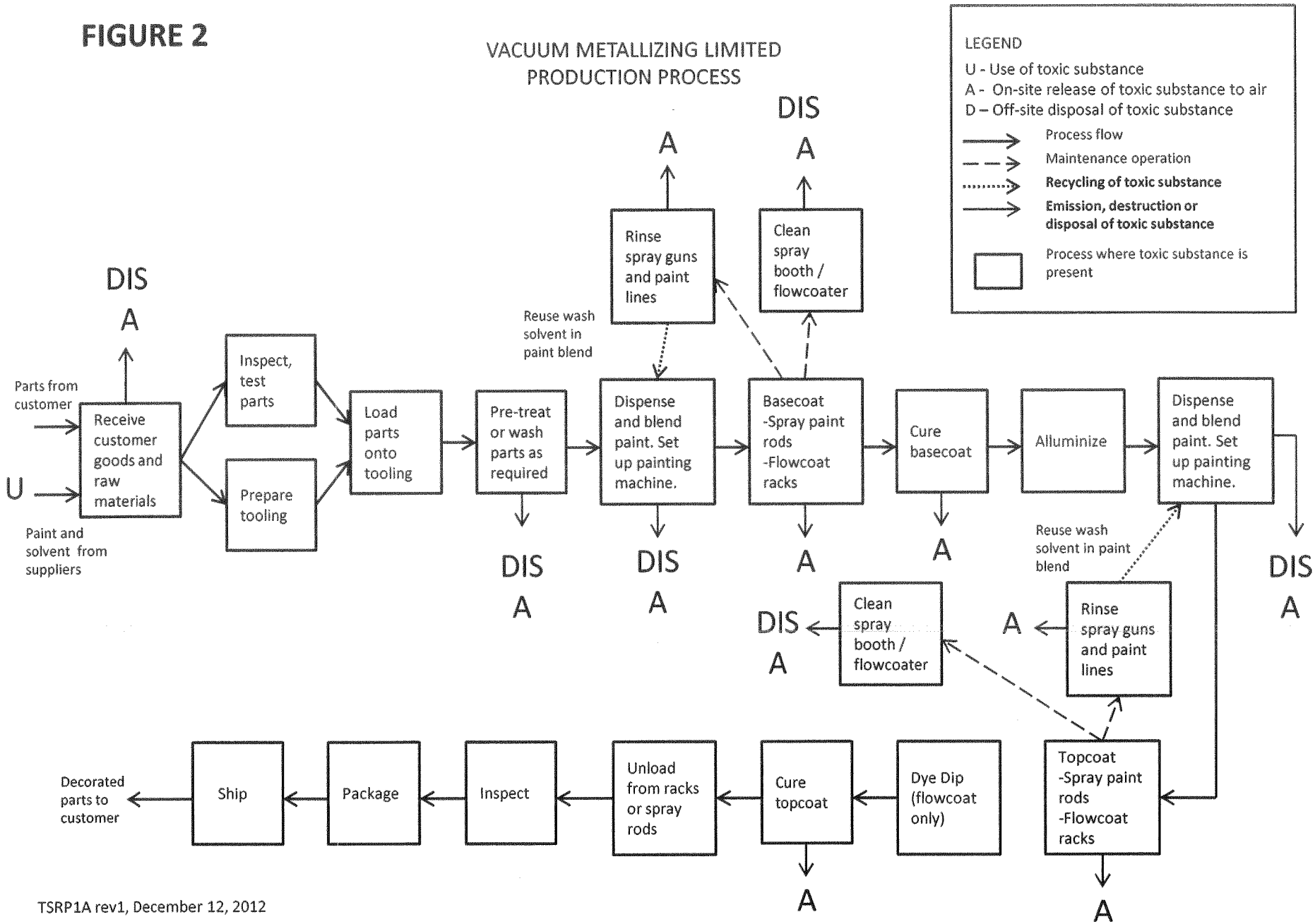

VACUUM METALLIZING LIMITED
PRODUCTION PROCESS
LEGEND
U - Use of toxic substance
A - On-site release of toxic substance to air
D – Off-site disposal of toxic substance
Process flow
Maintenance operation
Recycling of toxic substance
Emission, destruction or disposal of toxic substance
Process where toxic substance is present
Parts from customer
U
Paint and solvent from suppliers
Receive customer goods and raw materials
Inspect, test parts
Prepare tooling
Load parts onto tooling
Pre-treat or wash parts as required
Dispense and blend paint. Set up painting machine.
Basecoat -Spray paint rods -Flowcoat racks
Cure basecoat
Alluminize
Dispense and blend paint. Set up painting machine.
Reuse wash solvent in paint blend
Rinse spray guns and paint lines
Clean spray booth / flowcoater
Reuse wash solvent in paint blend
Rinse spray guns and paint lines
Clean spray booth / flowcoater
Topcoat -Spray paint rods -Flowcoat racks
Dye Dip (flowcoat only)
Cure topcoat
Unload from racks or spray rods
Inspect
Package
Ship
Decorated parts to customer
DIS
A

TABLE A1

NUMBER OF SPRAY RODS AND RACKS PROCESSED IN TYEAR 2011 DISTRIBUTED BY APPLIED COATING

	SPRAY - RODS						FLOWCOAT - RACKS			
MONTH	3001/AB35 BASECOAT	AB35/VB226 BASECOAT	3003 BASECOAT	33C36 BASECOAT	3003 TOPCOAT	3141 TOPCOAT	AB35 BASECOAT	AB35 TOPCOAT	33C36 BASECOAT	33C36 TOPCOAT
JAN	4,773	6,715	2,194	6,184	8,739	7,669	161	161	306	175
FEB	16,521	6,402	0	6,448	17,052	7,430	302	302	492	281
MAR	9,931	4,370	0	6,294	5,982	13,725	258	258	452	258
APR	2,547	3,169	86	12,270	3,133	14,485	248	248	341	195
MAY	4,705	7,349	916	12,424	6,249	15,709	116	116	730	417
JUN	7,152	4,840	910	9,738	14,251	8,097	285	285	91	52
JUL	7,573	11,496	0	8,900	20,051	7,261	189	189	362	207
AUG	7,940	7,885	0	8,400	13,081	6,089	459	459	453	259
SEP	621	7,484	0	5,400	5,717	6,050	247	247	327	187
OCT	3,380	9,826	0	7,050	13,192	6,597	174	174	208	119
NOV	18,612	8,814	0	6,040	19,130	10,285	457	457	212	121
DEC	2,906	6,656	0	3,052	7,138	5,428	50	50	194	111
YEAR	86,661	85,006	4,106	92,200	133,715	108,825	2,946	2,946	4,169	2,382
# stations[1]	100	100	100	100	100	100	6	6	6	6
% all loads	45%	40%	50%	100%	44%	100%	100%	100%	100%	100%
# loads	501	340	27	922	899	891	491	491	695	397
# stations[2]	48	50	50		49					
% all loads	35%	60%	50%		45%					
# loads	390	509	28		927					
# stations[3]	80				80					
% all loads	20%				4%					
# loads	223				223					
Tolal loads	1,114	849	55	922	2,049	891	491	491	695	397
			2,940 Basecoat		2,940 Topcoat Loads					

(1) 3001 - Smaller polypropylene caps, AB25/VB226 - smaller non polypropylene caps

(2) 3001/AB35- Empire-Emco bottles, AB35/VB226 - Brita

(3) Large jar covers

TABLE A2

ANNUAL USAGES AND DISTRIBUTION FACTORS FOR PAINT MIXES USED IN YEAR 2011

	Spray							
Paint	#Basecoat Loads	Litres Per Load	Usage	% Total	#Topcoat Loads	Litres Per Load	Usage	% Total
3001	0	0.0	0.0	0.00	0	0.0	0.0	0.00
3001/AB35	1,114	3.8	4,233.2	0.17	0	0.0	0.0	0.00
AB35/VB226	849	3.2	2,688.8	0.11	0	0.0	0.0	0.00
AB35	0	0.0	0.0	0.00	0	0.0	0.0	0.00
3003	55	3.8	209.0	0.01	2,049	3.8	7,786.2	0.31
33C36	922	2.6	2,416.6	0.09	0	0.0	0.0	0.00
3141	0	0.0	0.0	0.00	891	3.8	3,385.8	0.13
Total	2,940		9,547.5	0.375	2,940		11,172.0	0.439

	Flowcoat								
Paint	#Basecoat Loads	Litres Per Load	Usage	% Total	#Topcoat Loads	Litres Per Load	Usage	% Total	Total Usage
3001	0	0.0	0.0	0.00	0	0.0	0.0	0.00	0.0
3001/AB35	0	0.0	0.0	0.00	0	0.0	0.0	0.00	4,233.2
AB35/VB226	0	0.0	0.0	0.00	0	0.0	0.0	0.00	2,688.8
AB35	491	2.1	1,036.5	0.04	491	2.1	1,036.5	0.04	2,073.0
3003	0	0.0	0.0	0.00	0	2.4	0.0	0.00	7,995.2
33C36	695	1.1	792.3	0.03	397	1.1	452.6	0.02	3,661.4
3141	0	0.0	0.0	0.00	0	0.0	0.0	0.00	3,385.8
VISO	37	38.0	1,406.0	0.06	0	0.0	0.0	0.00	22,125.5
Total	1,223		3,234.8	0.127	888		1,489.1	0.059	25,443.4

TABLE A3

INCREASE/(DECREASE) OF TOXIC SUBSTANCES IN INVENTORY

Paint	MS	3001	VB226	AB35	3003	33C36	3141	ALL PAINTS
Opening inventory	0	2	1	1	1	1	4	
Closing inventory	2	3	1	3	7	1	20	
Increase/(Decrease)	2	1	0	2	6	0	16	
Litres Per Container	205.0	208.2	208.2	208.2	208.2	205.0	18.9	
Total litres	410.0	208.2	0.0	416.4	1249.2	0.0	302.4	2586.2
% xylene		36.3%				20.0%		
density xylene		0.868				0.868		
kg xylene		65.6				0.0		65.6
% MEK							20.0%	
density MEK							80.6%	
kg MEK							48.75	48.7
% MS		13.1%	63.4%	47.4%	65.0%	10.0%		
density MS		0.750	0.760	0.760	0.760	0.750		
kg MS	157.0	20.5	0.0	150.0	617.1	0.0		944.6

TABLE A4

FACILITY-WIDE ACCOUNTING FOR ALL TOXIC SUBSTANCES

Form of Involvement at the facility	PROCESS														All Processes
	Solvent Receiving and Storage	Pretreatment	Spray Paint Basecoat Preparation	Spray Paint Topcoat Preparation	Flowcoat Paint Basecoat Preparation	Flowcoat Paint Topcoat Preparation	Basecoat Spray Painting	Topcoat Spray Painting	Basecoat Flowcoating	Topcoat Flowcoating	Spray Painting Basecoat Curing	Spray Painting Topcoat Curing	Flowcoating Basecoat Curing	Flowcoating Topoat Curing	
Enters (use)	18081														18081
Created		0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Released to air		18.5	8.5	9.8	2.7	1.4	4783.0	6694.0	1570.8	777.2	1196.0	1673.4	392.7	194.2	17323
On-site disposal		incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	0.0	incl.	incl.	incl.
Released to land		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Released to water		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Off-site disposal		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Transferred for recycling off-site		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Contained is shipped product		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Transformed		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Destroyed at facilty		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Unaccounted/Imbalance	-145														
Remaining in storage	903														
PROCESSS % ALL PROCESSES		0.1%	0.0%	0.1%	0.0%	0.0%	27.6%	38.6%	9.1%	4.5%	6.9%	9.7%	2.3%	1.1%	100.0%

Recommendations of Toxic Reduction Planner: