TOXIC SUBSTANCE REDUCTION PLAN

FOR

HEPTANE

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

C. *TOXIC SUBSTANCE REDUCTION PLAN FOR HEPTANE (CAS 142-82-5)*

Heptane is one of five toxic substances used at the facility for which Toxic Substance Reduction Plans (TSRP's) are required. These solvents are all used in the same processes and in many situations are emitted together. To avoid unnecessary duplication, information common to all of the TSRP's is provided in a single Master Document and this Master Document is referenced by the TSRP for each toxic substance. Accordingly The Master Document and this TSRP for heptane comprise Vacuum Metallizing Limited's complete Toxic Substance reduction Plan for heptane.

1. *Facility Identification*

Refer to Master Document, Section 1.

2. *Contacts*

Refer to Master Document, Section 2.

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

Refer to Master Document, Section 3.

4. *Use of Heptane*

See Master Document, Section 4 for a description of how and where heptane and other solvents are used at Vacuum Metallizing Limited.

In 2011, all of the heptane used at the facility was purchased from suppliers in drums and used as a thinner in the paint formulations for the following paints: AB35 , VB226, 3003, AB235/VB226 (blend) and 3001/AB35 (blend). No heptane arrived at the facility in purchased paint. The following chart illustrates how these paints are used:

	Spray Paint Application		Flowcoat Paint Application	
	Basecoat	Topcoat	Basecoat	Topcoat
AB35			X	
VB226			X	
AB35/VB226	X			
3001/AB35	X			
3003		X		X

4.1 *Stages and Processes that Use Heptane*

See Master Document, Section 4.1 for a description of the stages and process at vacuum Metallizing Limited.

5. *Tracking of Heptane at the Process Level*

See Master Document, Section 5 for a description of each stage and process at Vacuum Metallizing Limited. A process flow diagram is provided for each process to provide a visual illustration of:

- how heptane enters the process
- whether heptane is created, destroyed or transformed during the process
- how heptane leaves the process and what happens to it after it leaves the process

Notational references contained in this TSRP document (e.g. U, Int1, Int2, Dis1, A3) are the same as those used in the Master Document.

The processes in which each of the above-listed paints containing heptane is used are as follows:

Receiving Stage – Solvent Receiving and Storage Process: All above-listed paints
Pretreatment Process – AB35, VB226
Basecoat Stage
Spray Painting Preparation, Spray Painting and Spray Paint Curing Processes:
AB35/VB226, 3001/AB35
Flowcoat Painting Preparation, Flowcoat Painting and Flowcoat Curing Processes:
AB35, VB226
Topcoat Stage
Flowcoat Painting Preparation, Flowcoat Painting and Flowcoat Curing Processes: 3003

6. *Tracking and Quantification of Heptane at the Process Level*

In this section, the following information is identified or presented for each of the processes identified in Section 5 in which heptane is used:

- the method or combination of methods used to track and quantify heptane in the process
- why the method or combination of methods was chosen
- the quantification of heptane in the process
- an explanation of any discrepancy between the input quantity (use of heptane) and the output quantity (release and disposal of heptane)

All heptane used at Vacuum Metallizing Limited is ultimately released to air or disposed of and none is transformed, destroyed or contained in products (i.e. in cured coatings applied onto customer-supplied components).

In this TSRP, individual releases and disposals of heptane exiting processes are not quantified and separated from cumulative releases where (a) the amount of an individual release/disposal is not measured, and (b) the quantity of the individual release/disposal is not significant relative to the quantity released/disposed by the primary source of release (e.g. the mass of heptane releases/disposals from maintenance activities as compared to the amount released/disposed from production activites). Measuring and quantifying these small releases would require source sampling and the associated expense cannot be financially justified considering the small amount of potential savings and the fact that any meaningful toxic substance/cost reduction strategy would not address these small individual address sources of release but would affect the use of all paints and solvents (and the toxic substances contained within them) in every process.

The information presented herein for each process, refers to the process description and corresponding process flow diagram presented in the Master Document.

SOLVENT RECEIVING AND STORAGE PROCESS

As noted, all paints that are purchased are received and moved to the Paint Storage Room (input U). Drums to be dispensed are moved onto a rack and stored in horizontal position. The paint may be used as a sprayed basecoat (Int2), a sprayed topcoat (Int3), a flowcoated basecoat (Int4) or a flowcoated topcoat (Int5). Heptane is used as a rinse agent prior to basecoating AB35 and VB226 paints in the flowcoater, (i.e. Pretreatment Process having heptane usage Int1). Heptane may evaporate upon removing the bung in a drum and inserting a dispensing valve, from a dispensing valve that leaks because it does not thread in or close properly, and from a rag used to clean up the spilled solvent (A1). Heptane may remain in the rag when it is thrown in the trash (Dis1).

Process input/output balance calculation: U = Int1 + Int2 + Int3 + Int4 + int5 + A1 + Dis1

a) Heptane that enters the process (U)

(i) Quantification Method : Mass Balance

Supplier invoices provide the number of containers received and the net weight of each.

(ii) Best Available Method Rationale:

This information is accurate and the method is cost effective as it is obtained directly from accounting documents and information supplied from the manufacturers of the paints and no additional measurements are required. Containers are not opened or damaged during this sub- process and they do not leak so 100% of received material is moved to the Paint Storage Room.

(iii) Data Quality:

The quality of the data is considered "High" for reasons presented above.

(iv) Calculations of total mass of heptane that enters the process:

kg heptane used in the process (U) = (# drums of heptane received) x (kg of heptane per drum)

= 14 drums x 142 kg/drum = 1,845 kg.

b) Heptane exiting the process (Int1, Int2, Int3, Int4, Int5, D1, A1):

(i) Quantification Method : Combination of mass balance, engineering calculations and "best guess" estimate.

As explained in the Master Document, the amounts of heptane released to air (A1) and disposed (D1) are considered to be negligible (i.e. A1 = D1 = 0). Accordingly, the total amount of heptane exiting the process (Int1+Int2+Int3+Int4+Int5+A1+D1) should be equal to the amount entering the process (U) less/plus any increase/decrease in the year-end inventory level versus the starting inventory level.

No records are made of the amount of paint and solvent material drawn from inventory for use in the individual processes at the facility.

"Best guess" estimate of the flowcoater department supervisor is used to estimate the amount of heptane exiting the process for use in the pretreatment process.

Engineering calculations are used to determine the amount of heptane contained in the paint mix used in each of the subsequent processes as follows:

Heptane usage = (number of production loads painted) x (volume of paint mix per load) x (percentage of paint mix that is heptane) x (density of heptane).

The total amount of heptane exiting the process and which enters a subsequent process is the sum of the calculated usages of heptane for all paints used in that subsequent process.

The number of production loads, paint mix formulas and paint mix consumption per production load are obtained from operating and production records. The density of heptane is obtained from supplier records.

(ii) Best Available Method Rationale:

This information is cost effective as it is obtained directly from the flowcoating department supervisor, accounting documents, NPRI/ECA documents, departmental supervisors and information supplied from the heptane supplier and no additional measurements are required.

In any event the method used is the only one available as the amounts of heptane drawn from inventory for use in each of the subsequent processes are not recorded and physical measurement is not effective because painted items vary considerably in shape, size and quantity requiring constant modification of machine operating settings.

(iii) Data Quality

The quality of the data is considered "Average" as quantifications are derived from fundamental scientific principles, relevant empirical data and judgement based on extensive observation. Only a relatively small amount of heptane exits the process for use in the Pretreatment Process so the low data quality for Int1 is not a significant consideration. (Although the data quality associated with the distribution of heptane usage between the five subsequent processes may not be as high as one would like, the data quality for the sum of the individual usages is "High".) Refer to *Data Quality* in Section 6 of the Master Document.

(iv) Calculations of total mass of heptane that exits the process:

Calculations for amounts of heptane leaving the process are presented in Table C1.

Amount exiting to the pretreatment process:

The flowcoating department supervisor advises that he rinsed parts an estimated 6 times in 2011 using one pail (18 litres) of solvent for this purpose, so total solvent usage in the pretreatment process was 6 x 18 =108 litres. Parts to be basecoated with AB35 or VB226 paint are rinsed with heptane, while those to be basecoated with 3001 are rinsed with MEK.

Records indicate that no 3001 was basecoated so all 108 litres of the solvent used for rinsing would have been heptane.

The mass of heptane entering the process (int1) is calculated as follows:

Int1 = (6 rinses) x (18 litres per rinse) x (density of heptane of 0.684 kg per litre) = 73.9 kg. Of this amount, 75% or 55.4 kg was reused in the Flowcoat Basecoat Paint Preparation Process (Rec1) , so the net loss to air A2 was 18.5 kg.

Mass of heptane exiting to the Spray Paint Basecoat Preparation Process (Int2), Spray Paint Topoat Preparation Process (Int3), Flowcoating Basecoat Paint Preparation Process (Int4) and Flowcoat Paint Topcoat Preparation Process (Int5) are presented in Table C1 and calculated as follows:

Int_n = (% heptane in thinner) x (% thinner in paint mix) x (litres paint mix per production load) x (density of heptane)

As presented in Table C1, the amounts of heptane that exited the process are as follows:

Int1 = 73.9 kg; Int2 = 540.3 kg; Int3 = 120.2 kg; Int4 = 552.8 kg ; Int5 = 608.2 kg

The value of Int4 shown here is 55.4 kg less than that shown in Table C1 reflecting the amount of heptane used in the Pretreatment process that is re-used in the Flowcoating Basecoat Process (i.e. that reduces the amount of heptane removed from inventory that enters the ensuing proces). Accordingly, Int4 = 608.2 – (0.75 x Int1) = 552.8 kg.
(Refer to Pretreatment Process, below.)

The input usage amount (U) of 1,988 kg does not equal the output amount (Int1+Int2+Int3+Int4+Int5) of 1,895 kg. One reason for the 92 kg (4.6%) difference is that input and output amounts were estimated using different methods. Input amount are based on purchasing and inventory records (which are precise) whereas output amounts are based on cost accounting/engineering calculations (which are based on estimated production rates, average reduction rates/paint concentrations, etc.) and plant operating records which are not always completed as accurately as management would like.

PRETREATMENT PROCESS

As noted above the flowcoating department supervisor estimates that in year 2011 he performed this procedure 6 times using 73.9 kg of heptane. He also estimates that approximately 25% of the heptane evaporated during the process and 75% was drained from the flowcoater after the process and was reused in AB35 and VB226 paint formulation.

Although it is possible that some heptane spilled onto the floor during this process, the amount would have been small and (considering heptane's relatively high evaporation rate) any spilled heptane would have evaporated (i.e. Dis2 = 0).

Process input/output balance calculation: Int1 = A2 + Dis2 + Rec1
A2 = 0.25 x Int1
Rec1 = 0.75 * Int1

a) Heptane that enters the process (Int1)

(i) Quantification Method : "Best Guess" Estimate

Relying on the memory and words of the flowcoater department supervisor.

(ii) Best Available Method Rationale:

This is the only available method as inventory and operating records were not kept for this process.

(iii) Data Quality:

The quality of the data is considered "Uncertain".

(iv) Calculations of total mass of heptane that enters the process:

The input amount Int1 is 73.9 kg as calculated in (b)(iv) of the Receiving and Storage Process, above.

b) Heptane exiting the process (A2, Dis2, Rec1):

(i) Quantification Method: "Best Guess" Estimate.

Relying on the memory and words of the flowcoater department supervisor for all information used in the mass calculation (i.e. rinse frequency, litres of solvent per rinse, which solvent was used and the proportion of the rinse solvent that was recycled/evaporated).

(ii) Best Available Method Rationale:

This is the only available method as inventory and operating records were not kept for this process.

(iii) Data Quality:

The quality of the data is considered "Uncertain".

(iv) Calculations of total mass of heptane that enters the process:

As calculated previously:
Amount released to air A2 = 0.25 x Int1 = 0.25 x 73.9 = 18.5 kg
Amount recycled Rec1 = 0.75 x Int1 = 0.75 x 73.9 = 55.4 kg
Amount disposed of Dis2 = 0.0 kg

PAINT PREPARATION PROCESSES

Paint mix for use in a spray or flowcoating application is blended in or in front of the Paint Storage Room in open containers. The open pails of paint mix and heptane (used to maintain the viscosity/specific gravity of paint mix in the flowcoater) are transported by hand or using a dolly to the spray booth or flowcoater. Heptane is released to air during the time that paints and solvents are being dispensed and transported to the work station. If material spills from a pail during dispensing or transport, heptane is released to air from the spilled material and from rags used to wipe up the spill. Heptane remaining in the rags is disposed of when the rags are discarded.

Process input/output balance calculations:
Spray Paint Basecoat Preparation Process: Int2 = Int6 + A3 + Dis3
Spray Paint Topcoat Preparation Process: Int3 = Int7 + A4 + Dis4
Flowcoat Paint Basecoat Preparation Process: Int4 = Int8 + A5 + Dis5
Flowcoat Paint Topcoat Preparation Process: Int5 = Int9 + A6 + Dis6

a) Heptane that enters the process (Int2, Int3, Int4+Rec1, Int5):

Int2 = 540.3.4 kg; Int3 = 120.2 kg; Int4+Rec1 = 552.8 + 55.4 kg = 608.2 kg; Int5 = 608.2 kg. (Int4+Rec1) represents the total amount of heptane used to flowcoat basecoats which is the amount which arrives directly from the Paint Storage Room plus 75% of the of heptane which was used for rinsing and which is being recycled for use as a basecoat thinner in the Flowcoating Process. Refer to Solvent Receiving and Storage and Pretreatment Processes, above.

b) Heptane exiting the process (Int6+A3+Dis3, Int7+A4+Dis4, Int8+A5+Dis5, Int9+A6+Dis6):

Some small amount of heptane that enters the process evaporates when paint is dispensed and blended or when paint mix is spilled during dispensing/blending and transport to the painting machine and from rags used to clean up this spill (collectively A_x). Any heptane remaining in the rags is discarded along with the rags (Dis_x). No measurements are taken or records maintained to record spills because a spill occurs infrequently and involves a relatively small and insignificant amount of paint. Heptane has a moderate evaporation rate (2.2 vs nBA) and pails are not left open for more than a few minutes at a time so the amount of a solvent lost through evaporation in this process is not significant, measured or recorded.

(i) Quantification Method : Combination of Mass Balance and "Best Guess" Estimates

Mass Balance because input amounts equal or almost equal output amounts. The amounts of heptane exiting to air or disposed of are provided from the memory and opinions of departmental supervisors.

(i) Best Available Method Rationale: No data is recorded concerning the frequency and volume of spilled paints so this information is based on the memory and opinions of the painting department supervisors.

(ii) Data Quality:

Because the output mass of heptane is almost equal to input mass (i.e. significant loss to spills is not experienced), the quality of the data for the process output is no better or worse than that of the input. Accordingly the data is considered "Average".

(iii) Calculations of total mass of heptane that exits the process:

Assumptions:

- No amount of heptane released to air during dispensing and transport unless a spill occurs
- Spills occur on average once per week during blending or transport
- Each spill involves approximately one litre of paint mix
- Paint spills are distributed among paints/processes in accordance with their relative usages.

The formula for calculating mass of heptane exiting the process due to spills is as follows:

kg heptane used = (49 spills per year) x (distribution factor for paint/process combination) x (1 litre of paint mix per spill) x (% of paint mix that is heptane) x (density of heptane)

Calculations for the amounts of heptane exiting the process on account of spills are shown in Table C2. These amounts (in kg) are as follows:

(A3+Dis3) = 1.1 kg, (A4+Dis4) = 0.5 kg, (A5+Dis5) = 0.6 kg, (A6+Dis6) = 0.6 kg

Amounts exiting each process which are in turn inputs for subsequent painting processes are as follows:

Spray Paint Basecoat Preparation Int6 = Int2 - A3 - Dis3 = 540.3 - 1.1 = 539.2 kg
Spray Paint Topcoat Preparation Int7 = Int3 - A4 - Dis4 = 120.2 kg – 0.5 kg = 119.7 kg
Flowcoat Paint Basecoat Preparation Int8= Int4+Rec1-A5-Dis5 = 608.2 - 0.6 =607.6kg
Flowcoat Paint Topcoat Preparation Int9 = Int5 - A6 - Dis6) = 608.2 – 0.6 = 607.6 kg

SPRAY PAINTING AND FLOWCOATING PROCESSSES

In both spraying and flowcoating processes, heptane is released to air in/from the painting machine while paint mix is being applied onto components and from the uncured coating on components that have been painted and which are being staged for the subsequent convection curing process . In the spray painting process, some amounts of heptane are released to air from daily and periodic machine maintenance operations and from the disposal of associated waste materials. In the flowcoating process, some amounts of heptane are released from paint remaining in the paint sump when the flowcoater is not in use. Releases/disposals are quantified as (A7+Dis7) from spray painting basecoats, (A8+Dis8) from spray painting topcoat, A9 from flowcoating basecoats and A10 from flowcoating topcoats.

Heptane is not used in rinsing spray paint lines but is used in rinsing flowcoaters after basecoating . Considering that new heptane is drawn and reused as thinner, the rinsing has no real impact on heptane use and any release to air due to rinsing is already factored into release A9. Accordingly, Rec2 is deemed to be nil.

Process input/output balance calculation:

Basecoat Spray Painting Process:	Int6 = Int10 + A7 + Dis7
Topcoat Spray Painting Process:	Int7 = Int11 + A8 + Dis8
Basecoat Flowcoating Process:	Int8 = Int12 + A9 + Rec2
Topcoat Flowcoating Process:	Int9 = Int13 + A10

a) Heptane that enters the process (Int6, Int7, Int8+Rec1, Int9):

Int6 = 539.2 kg, Int7 = 119.7 kg, Int8 = 607.6 kg, Int9 = 607.6 kg. Refer to Paint Preparation Process (b) (iv) and Pretreatment process (b)(iv), above.

Note that 75% of heptane used in Pretreatment Process is recycled and used in the Flowcoating Basecoat Painting Process. Accordingly, usage for this process is the sum of new heptane exiting the Flowcoat Paint Basecoat Preparation Process and recycled heptane from the Pretreatment Process.

b) Heptane exiting the process (Int10+A7+Dis7, Int11+A8+Dis8, Int12+A9, Int13+A10):

The greatest amount of heptane exiting the process is released to air during paint application. A lesser amount exiting the process is contained in uncured paints on parts that are moved to the Curing Process (int10, Int11, Int12, Int13). Less significant amounts of heptane evaporate from the surface of coated parts collecting on carts (until the carts are filled at which time they are moved to the curing oven and are released/disposed of from maintenance activities).

(i) Best Available Method Rationale:

A common convention used in the painting industry is that 80% of solvents are released from an applied coating during the coating process with the remaining 20% released during the curing process. This analysis uses this convention to determine the mass of heptane exiting the process and moving to the Curing Process. Because no data is available to quantify heptane exiting the process from maintenance activities or from uncured coating on standing parts, amounts of releases to air and disposals are calculated in the aggregate.

(ii) Data Quality:

The quality of the data is considered "Average" because the analysis uses a common industry convention which does not take into account the specific processes and materials used at VML.

(iii) Calculations of total mass of heptane that exits the process:

Convention: 80% of heptane in applied paint is released in the process and 20% is released in the subsequent curing process.

Amounts exiting each process are as follow

Basecoat Spray Painting Process:	Int10 = 0.2 x Int6 = 0.2 x 539.2 = 107.8 kg (A7 + Dis7) = .8 x Int6 = 431.3 kg
Topcoat Spray Painting Process:	Int11 = 0.2 x Int7 = 0.2 x 119.7 = 23.9 kg (A8 + Dis8) = 0.8 x Int7 = 95.8 kg
Basecoat Flowcoating Process:	Int12 = 0.20 x Int8 = 0.20 x 607.6 =121.5 kg A9 = 0.8 x Int8 = 486.1 kg
Topcoat Flowcoating Process:	Int13 = 0.2 x Int9 = 0.2 x 607.6 = 121.5 kg A10 = 0.8 x Int9 = 486.1 kg

SPRAY PAINT AND FLOWCOAT PAINT CURING PROCESSSES

All painted coatings are full cured in a convection oven and it is assumed that 100% of heptane entering this process exits the process to air.

Process input/output balance calculation:

Spray Painting Basecoat Curing Process:	Int10 = A11
Spray Painting Topcoat Curing Process:	Int11 = A12
Flowcoating Basecoat Curing Process:	Int12 = A13
Flowcoating Topcoat Curing Process:	Int13 = A14

a) Heptane that enters the process (Int6, Int7, Int8, Int9):

Int10 = 107.8 kg, Int11 = 23.9 kg, Int12 = 121.5 kg, Int13 = 121.5 kg. Refer to Spray Painting and Flowcoating Processes (b)(iv), above.

c) Heptane exiting the process (A11, A12, A13, A14):

(i) Best Available Method Rationale:

Method is based on extensive observation and logic and is the only one that makes sense.

(ii) *Data Quality*:
Because the output mass of heptane is equal to input mass, the quality of the data for the process output can be no better than that of the input. Accordingly the data is considered "Average".

(iii) *Calculations of total mass of heptane that exits the process:*
Amounts exiting each process are the same as those entering the process as follows:

Spray Painting Basecoat Curing Process:	A11 = Int10 = 107.8 kg
Spray Painting Topcoat Curing Process:	A12 = Int11 = 23.9 kg
Flowcoating Basecoat Curing Process:	A13 = Int12 = 121.5 kg
Flowcoating Topcoat Curing Process:	A14 = Int13 = 121.5 kg

FACILTY-WIDE ACCOUNTING

Although all use of heptane by the facility is accounted for, as noted in (b)(iv) of the Solvent Receiving and Storage Process, there is a variance of 93 kg (4.6%) between the input usage amount (U) of 1,988 kg (reported to NPRI) and the net amount of heptane used after allowing for heptane recycled from the Pretreatment Process of 1,895 kg calculated herein. (Note that total amount of heptane used was 1951 kg or only 37 kg less.) This is due to different procedures having been used for reporting NPRI emissions and for calculating usages in this TSRP.

Facility-level quantification data for heptane used at Vacuum Metallizing Limited in year 2011 is outlined in Table C3.

7. *Opportunities for Reducing the Use of Heptane*

Refer to Master Document, Section 7 for a general discussion about opportunities for reducing solvent use at Vacuum Metallizing Limited, for a list of options that were considered and evaluated.

As noted in the Master Document, Option (i), "*Recapture, recycle offsite and re-use solvents used to rinse spray guns and paint lines*" is the only option identified as being technically and economically feasible. However, in year 2011 this option did not apply to heptane as only mineral spirits was used for the subject purpose.

8. *Economic Analysis of Opportunities for Reduction in Use of Heptane*

Direct cost: Annual purchases of heptane: 1,988 kg x $1.66/kg = $3,300

Indirect Costs: Receiving and storing heptane
Dispensing heptane
Paying supplier Invoices
Building overheads associated with plant storage area
Equipment maintenance costs
Spill cleanup costs

Personal protective equipment cost
Compliance reporting cost
Employee training cost
Limitation on production output due to MOE emission limits

The following are economic evaluations for each of the options identified as potentially reducing the use of heptane. Note that for each option, the possible impact of each of the above indirect costs was considered and that where an indirect cost does not appear in the analysis, it was determined that the indirect cost had a negligible impact, or that the indirect cost was not applicable to the subject option.

i) Option (c): Replace heptane with non-voc solvent
Assume same volume of heptane and of replacement solvent would be required.
Cost of heptane non-voc replacement solvent:
= 1,988 kg ÷0.684 kg /l = 2,906 litres x $3.40/litre (estimate) = $9,880.

The increase in cost associated with Option (c) (before supplier markups) would be $9,880 - $3,300 = $6,580.

Identified potential indirect cost savings and an evaluation of each are as follows:

Potential Savings:	Ability to increase production output without exceeding MOE emission limits
Evaluation:	*No impact as company is operating under the limit and is unlikely to exceed it.*
Potential Savings:	Reduced compliance reporting costs.
Evaluation:	*Cost would not decrease with the implementation of this option because replacements are not available for all toxic substances used at the facility so compliance reporting would still be required. In addition, the cost of compliance reporting is not variable because reporting is performed by the company president who whose pay would remain the same regardless of whether or not he performs this function or how many hours he works.*
Conclusion:	*Option is not economically feasible because it would result in significant increase in cost.*

ii) Options (i) and (j): Recapture, recycle on-site/off-site and reuse solvents used to clean spray guns and paint lines

Options do not apply to heptane.

iii) Option (l): Purchase heptane in smaller quantities:

Heptane is only purchased in drums for use as paint thinner. Only one or two drums are purchased per order and this quantity cannot be reduced. An economic analysis is

Evaluation: *Ordering heptane in smaller lots would require that heptane be supplied in pails resulting in higher per unit solvent cost, material handling and dispensing costs. A detailed economic analysis is not required to determine that this option does not make sense for the company.*

Conclusion: *Option is not economically feasible.*

9. *Implementation of Opportunities for Reducing the Use of Heptane*

Vacuum Metallizing Limited does not plan to implement any of the identified options to reduce the usage of heptane at the facility because no option was found to be both technically and economically feasible at the present time for reasons presented in the Master Document.

As noted, Option (d) "*Replace HVHP spray guns with more efficient LVLP or LVHP spray guns*" is to be evaluated and results included in the June 1st TSRP update.

The company will continue to monitor the availability and cost of a non-voc replacement for heptane and include updated evaluation(s) in the TSRP updates.

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 uses or creates the toxic substance heptane, 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 plan for heptane dated December 15, 2012 and that the plan complies with the act and Ontario Regulation 455/09 (General) made under that Act.

MKaleem

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 plan for heptane 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 plan dated December 15, 2012 for heptane and am familiar with its contents and to my knowledge the version of the plan is factually accurate and complies with the *Toxics Reduction Act, 2009* and Ontario Regulation 455/09.

J Sugar

Jeffrey Sugar, President
Vacuum Metallizing Limited

TABLE C1

AMOUNT OF HEPTANE EXITING THE SOLVENT RECEIVING AND STORAGE PROCESS (AMOUNTS ENTERING SUBSEQUENT PROCESSES)

PAINT	SUBSEQUENT PROCESS	PROCESS ID	HEPTANE IN THINNER (%)	THINNER IN PAINT MIX (%)	HEPTANE IN MIX (%)	MIX PER PRODUCTION LOAD (litres)	HEPTANE PER PRODUCTION LOAD (litres)	MAINTENANCE THINNER (litres)	DENSITY OF HEPTANE (kg/litre)	HEPTANE PER PRODUCTION LOAD (kg)	PRODUCTION LOADS	SUBTOTAL HEPTANE USED (kg)	HEPTANE REUSED (kg)	NET HEPTANE USED (kg)
AB35, VB226	Pretreatment*	Int1										73.9	-55.4	18.5
AB35/VB226	Spray Basecoat		50.0%	27.3%	13.6%	3.2	0.43		0.684	0.295	849	250.8	0.0	250.8
3001/AB35	Spray Basecoat		50.0%	20.0%	10.0%	3.8	0.38		0.684	0.260	1,114	289.6	0.0	289.6
Subtotal	Spray Basecoat	Int2										540.3	0.0	540.3
3003	Spray Topcoat	Int3	50.0%	50.0%	25.0%	3.8	0.95		0.684	0.650	185	120.2	0.0	120.2
AB35	Flowcoat Basecoat		61.5%	66.7%	41.0%	2.1	0.87	0.95	0.684	1.239	491	608.2	0.0	608.2
VB226	Flowcoat Basecoat		61.5%	66.7%	41.0%	2.4	0.97	0.95	0.684	1.313	0	0.0	0.0	0.0
Subtotal	Flowcoat Basecoat	Int4										608.2	0.0	608.2
AB35	Flowcoat Topcoat		61.5%	66.7%	41.0%	2.1	0.87	0.95	0.684	1.239	491	608.2	0.0	608.2
3003	Flowcoat Topcoat		100.0%	66.7%	66.7%	2.4	1.58	0.95	0.684	1.729	0	0.0	0.0	0.0
Subtotal	Flowcoat Topcoat	Int5										608.2	0.0	608.2
TOTAL												1,950.9	-55.4	1,895.5

TABLE C2

ALLOCATION AMONG PROCESSES OF HEPTANE EXITING PAINT PREPARATION PROCESSES DUE TO SPILLS

PAINT DISPENSED IN PAILS	SUBSEQUENT PROCESS	PROCESS ID	TOTAL MIX SPILLED (litres)	DIST'N FACTOR (Table A2)	ALLOCATED SPILL VOLUME (litres)	HEPTANE IN SPILLED MIX (%)	ALLOCATED HEPTANE IN PAINT (litres)	DENSITY OF HEPTANE (kg/litre)	HEPTANE IN SPILLED PAINT (kg)
AB35/VB226	Spray Basecoat		49	0.17	8.3	13%	1.10	0.684	0.7
3001/AB35	Spray Basecoat		49	0.11	5.4	10%	0.54	0.684	0.4
Subtotal	Spray Basecoat	A3+Dis3	49	0.28	13.7	12%	1.63	0.684	1.1
3003	Spray - Topcoat	A4+Dis4	49	0.03	1.4	50%	0.69	0.684	0.5
AB35	Flowcoat Basecoat		49	0.04	2.0	41%	0.80	0.684	0.6
VB226	Flowcoat Basecoat		49	0.00	0.0	41%	0.00	0.684	0.0
Subtotal	Flowcoat Basecoat	A5+Dis5	49	0.04	2.0	41%	0.80	0.684	0.6
AB35	Flowcoat Topcoat		49	0.04	2.0	41%	0.80	0.684	0.6
3003	Flowcoat Topcoat		49	0.00	0.0	67%	0.00	0.684	0.0
Subtotal	Flowcoat Topcoat	A6+Dis6	49	0.04	2.0	41%	0.80	0.684	0.6
TOTAL					17.6	18%	3.2	0.684	2.8

TABLE C3

FACILITY-WIDE ACCOUNTING FOR HEPTANE

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)	1988														1988
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	0
Released to air		18.5	1.1	0.5	0.6	0.6	431.3	95.8	486.1	486.2	107.8	23.9	121.50	121.5	1895
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	93														
Remaining in storage*	0														

Toxic Reduction Planner's Recommendations: