Toxics Reduction Plan

Dioxins and Furans
Hexachlorobenzene

Prepared by:

SAPA Canada Inc.
7 Alloy Court
Toronto, ON
M9M 3A2

December 2013

Contents

Statement of Intent

SAPA is committed to reducing the environmental impact of its manufacturing operations by implementing the principle of pollution prevention in daily activities. Key activities include continually seeking ways to reduce the creation of toxic substances.

Objective

SAPA will continue to explore new technologies with the goal of reducing use of toxic substances. As new technologies become available, SAPA will explore the economic feasibility to determine which options will be implemented.

1.0 Facility Information

Toxic Substances	Dioxins and Furans, hexachlorobenzene
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7
Hexachlorobenzene	118-74-1
Number of full-time equivalent employees	53
NAICS	331529 Non-Ferrous Foundries
NPRI ID	1480
UTM NAD83 coordinates (entrance)	618318, 4843577

Canadian Parent Company

Legal name	n/a
Street address	n/a
% owned by parent	n/a
CCRA business number	n/a

Contact info

Owner and operator of facility	SAPA Canada Inc.

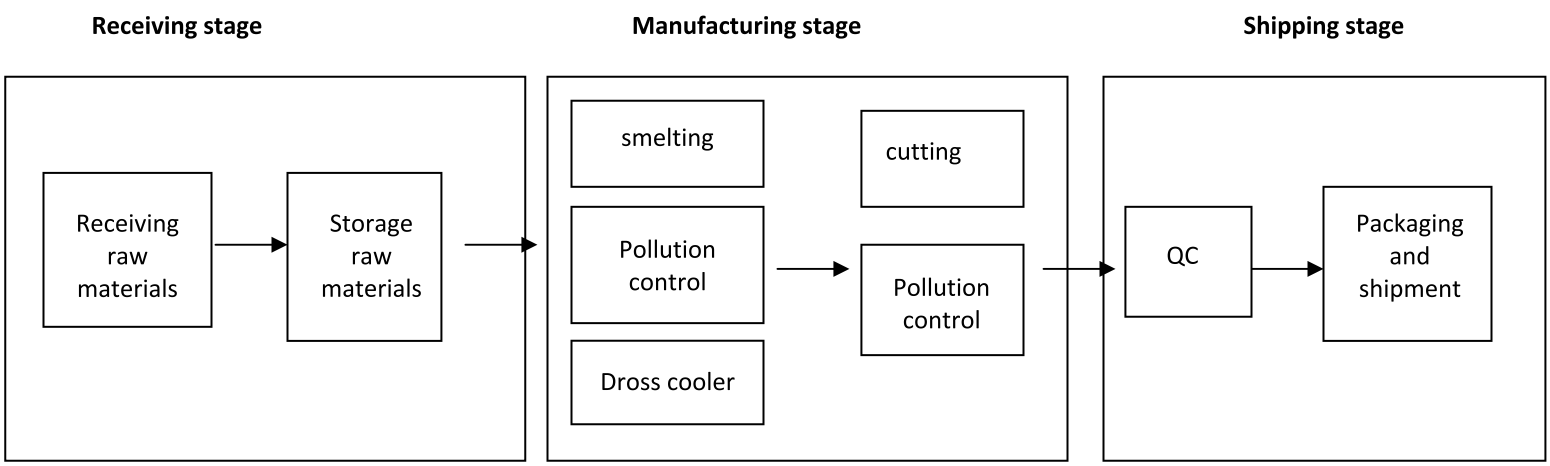
	7 Alloy Ct Toronto, ON M9M 3A2
Highest ranking employee	Yong Lee General Manager SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 yong.lee@sapagroup.com
Person who coordinated preparation of plan	Michael Zorayan SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 michael.zorayan@sapagroup.com
Person who prepared plan	Wendy Nadan Nadan Consulting Ltd 151 Montgomery Blvd Orangeville ON L9W 5C1 519 940 4724 wendy@nadanconsulting.com
Public contact	Michael Zorayan SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 michael.zorayan@sapagroup.com
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
TRSP 0092

2.0 Identification of Stages and Processes



Manufacturing processes
The SAPA casthouse receives used aluminum for recycling as well as sows and clean scrap that are used as raw materials in the smelting process. Contaminated scrap is placed in a separate furnace that volatilizes contaminants and sends them to an incinerator for destruction. The emissions from the incinerator are routed through a baghouse to collect particulate matter.

The scrap furnace operates at a roof temperature of approx.920C with the incinerator operating at 1015C to destroy organic matter and minimise formation of dioxans, furans and hexachlorobenzene.

Clean scrap and sows are melted in separate furnaces that operate at a roof temperature of 795C. Once the metal is molten, it is sent to a holding furnace. From the holding furnace, the molten metal is sent to the casting unit and homogeniser. The metal is held in the furnace for approximately 30 minutes until the target temperature has been attained and is then sent to the casting unit for immediate pouring. The homogenizer operates at approx. 595C which allows components (primarily silicon and manganese) to disperse in the solid phase rather than accumulate. Once cooled, the metal is sawn into billets and shipped to customers. There are 4 to 6 pours per 12 hour shift.

Polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF) and hexachlorobenzene are formed unintentionally as byproducts of waste combustion and many other thermal industrial processes. There must be a source of chlorine and organic matter in the process for formation to occur.

Just as combustion provides a means for formation, so too does it allow for its destruction, through careful controls. A high combustion temperature, adequate combustion time, and turbulence to distribute heat all contribute to maximize destruction. Formation following combustion is prevented by quickly cooling combustion gases, and minimizing the presence of certain metals known to promote formation.

The gases from the scrap furnace are sent to an incinerator for destruction of the dioxins, furans and hexachlorobenzene. The gas stream from the incinerator is subject to lime injection which reacts with the dioxins, furans and hexachlorobenzenes, neutralising and destroying them. The lime is collected in a baghouse in which the bags are also coated with lime.

The waste from the baghouse has been tested and is non-detect for dioxins, furans and hexachlorobenzene. Hence, it is assumed that all of these species that come into contact with the lime have been destroyed. The baghouse waste is sent to landfill for disposal.

Material Accounting Calculations
See the NPRI supporting information for process flow charts and detailed calculations.

The emission of dioxins, furans and hexachlorobenzene is calculated based on approved stack testing results. Data quality is therefore considered above average.

The quantity of dioxins, furans and hexachlorobenzene created is unknown as it is dependent on the quantity of chlorine and organic matter in the feedstock and the temperature of the process stream. The quantity of created could be determined by testing the gas stream exiting the scrap furnace however this test is expensive and is not considered to add any value.

Hence, inputs are unknown however there are only two outputs – destruction and emission to air. Air emissions are known from stack testing and the absence in baghouse dust has been confirmed by testing. It is therefore assumed that inputs and outputs are approximately equal.

3.0 Estimated Direct and Indirect Costs

Dioxins, furans and hexachlorobenzene are created during the smelting of contaminated scrap. As they are unwanted byproducts inherent to the process, there are no options to reduce the creation. Hence the current cost of creation is not used in any economic feasibility and analysis and at this time has not been quantified. If a technically feasible option is found, the cost of creation will be developed for use in the economic analysis.

4.0 Identification of Options for Reduction in Creation of Dioxins, Furans and Hexachlorobenzene

The following options were identified to reduce the creation of dioxins, furans and hexachlorobenzene.

Category	Description
Material substitution	Option #1: Eliminate scrap aluminum from the raw material stream, eliminating the source of chlorine and organic matter. This would reduce creation of dioxins and furans by 100% and air emissions by 0.0109g or 100%.
Product design	Product supplied to the customer is a raw material into an extrusion process. There are no dioxins or furans contained in the product. Redesign of the product would not reduce the creation of dioxins, furans or hexachlorobenzene.
Process modification	Option #2: Switch from lime injection to carbon or a combination of both for pollution control. Carbon removes dioxins, furans and hexachlorobenzene by adsorption so that the baghouse waste will contain the congeners. Waste will have to be disposed of as hazardous waste rather than regular garbage, adding cost and an additional environmental aspect.
Spill and leak prevention	Option #3: Implement a preventative maintenance program on the lime injection system to ensure there is optimum destruction. An annual PM program has already been implemented to maintain optimum operating conditions so this option will not be pursued further.
Reuse or recycling	Dioxins, furans and hexachlorobenzene cannot be reused or recycled as they are an unwanted by product of the process.
Inventory management	Dioxins, furans and hexachlorobenzene are not part of the input stream and are targeted for destruction in the process therefore there is no inventory to manage.
Training	The melting and casting process is highly automated and operators have little flexibility to change process parameters. Operators have no control over the composition of raw materials which is one of the key factors in dioxin, furan and hexachlorobenzene creation. Therefore there is no training option available.

5.0 Analysis 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

The results are recorded in the following table:

Option	Technical Feasibility	Feasible
Option #1: Eliminate contaminated scrap	The purpose of the facility is to recycle used and painted aluminum. Hence, eliminating this function would cause other effects that have a negative environmental impact ie necessitate greater use of virgin aluminum which causes air emissions and uses large amounts of energy in the smelting process.	No
Option #2: Switch to carbon absorption	The carbon introduces a fire risk to the process. Baghouses will have to be equipped with sprinklers to meet the Fire Code however sprinkler systems are contraindicated in the entire facility due to the risk of explosion in the furnaces if any water is introduced into the process.	No

6.0 Economic Feasibility

As there are no technically feasible options, no economic feasibility is necessary.

7.0 Implementation of Options

There are no technically feasible options available to reduce the creation of dioxins, furans and hexachlorobenzene. Hence there are no objectives to reduce the creation of dioxins and furans.

8.0 Planner Recommendations

As the planner has worked with the facility throughout the development of the plan, any suggestions to improve the plan have been incorporated into the document. Thus, there are no further recommendations at this time.

9.0 Certification

As of December 12, 2013, I, Yong Lee, certify that I have read the toxic substance reduction plan for dioxins, furans and hexachlorobenzene 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 with the exception of the regulatory deadline.

Yong Lee, General Manager

Date

As of December 13, 2013, I, Wendy Nadan certify that I am familiar with the processes at SAPA Canada Inc. that create dioxins, furans and hexachlorobenzene, 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 December 13, 2013 and that the plan complies with that Act and Ontario Regulation 455/09 (General) made under that Act with the exception of the regulatory deadline.

December 13, 2013

Wendy Nadan, Toxic Substance Reduction Planner

Date

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Wendy Nadan, Toxic Substance Reduction Planner

December 13, 2013
Date

Toxics Reduction Plan
Manganese

Prepared by:

SAPA Canada Inc.
7 Alloy Court
Toronto, ON
M9M 3A2

December 2013

Contents

Statement of Intent

SAPA is committed to reducing the environmental impact of its manufacturing operations by implementing the principle of pollution prevention in daily activities. Key activities include continually seeking ways to reduce the usage of toxic substances.

Objective

SAPA will continue to explore new technologies with the goal of reducing use of toxic substances. As new technologies become available, SAPA will explore the economic feasibility to determine which options will be implemented.

1.0 Facility Information

Toxic Substance	Manganese
CAS#	7439-96-5
Number of full-time equivalent employees	53
NAICS	331529 Non-Ferrous Foundries
NPRI ID	1480
UTM NAD83 coordinates (entrance)	618318, 4843577

Canadian Parent Company

Legal name	n/a
Street address	n/a
% owned by parent	n/a
CCRA business number	n/a

Contact info

Owner and operator of facility	SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2
Highest ranking employee	Yong Lee General Manager SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 yong.lee@sapagroup.com
Person who coordinated preparation of plan	Michael Zorayan SAPA Canada Inc.

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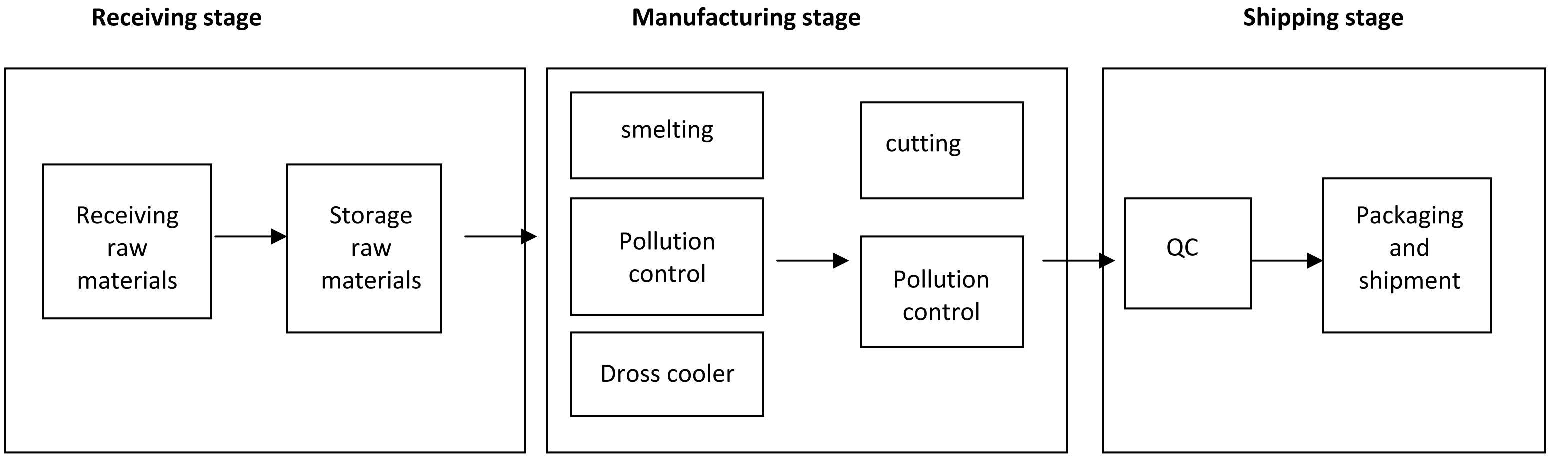
2.0 Identification of Stages and Processes



Manufacturing processes
The SAPA casthouse receives used aluminum for recycling as well as sows and clean scrap that are used as raw materials in the smelting process. Contaminated scrap is placed in a separate furnace that volatilizes contaminants and sends them to an incinerator for destruction. The emissions from the incinerator are routed through a baghouse to collect particulate matter.

The scrap furnace operates at a roof temperature of approx.920C with the incinerator operating at 1015C to destroy organic matter and minimise formation of dioxans and furans.

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Other metals are required in the aluminum to provide specific properties. It would be very unusual to find pure aluminum (1xxx series of alloys) chosen for structural fabrication because of their strength characteristics. Although the 1xxx series are almost pure aluminum, they will respond to strain hardening and especially so if they contain appreciable amounts of impurities such as iron and silicon. However, even in the strain-hardened condition, the 1xxx series alloys have very low strength when compared to the other series of aluminum alloys. When the 1xxx series alloys are chosen for a structural application, they are most often chosen for their superior corrosion resistance and/or their high electrical conductivity. The most common applications for the 1xxx series alloys are aluminum foil, electrical buss bars, metallizing wire and chemical tanks and piping systems.

The addition of alloying elements to aluminum is the principal method used to produce a selection of different materials that can be used in a wide assortment of structural applications.

Series	*Primary Alloying Element*
1xxx	Aluminum - 99.00% or Greater
2xxx	Copper
3xxx	Manganese
4xxx	Silicon
5xxx	Magnesium
6xxx	Magnesium and Silicon
7xxx	Zinc

The principal effects of alloying elements in aluminum are as follows:

Copper (Cu) 2xxx – The aluminum-copper alloys typically contain between 2 to 10% copper, with smaller additions of other elements. The copper provides substantial increases in strength and facilitates precipitation hardening. The introduction of copper to aluminum can also reduce ductility and corrosion resistance. The susceptibility to solidification cracking of aluminum-copper alloys is increased; consequently, some of these alloys can be the most challenging aluminum alloys to weld. These alloys include some of the highest strength heat treatable aluminum alloys. The most common applications for the 2xxx series alloys are aerospace, military vehicles and rocket fins.

Manganese (Mn) 3xxx – The addition of manganese to aluminum increases strength somewhat through solution strengthening and improves strain hardening while not appreciably reducing ductility or corrosion resistance. These are moderate strength nonheat-treatable materials that retain strength at elevated temperatures and are seldom used for major structural applications. The most common applications for the 3xxx series alloys are cooking utensils, radiators, air conditioning condensers, evaporators, heat exchangers and associated piping systems.

Silicon (Si) 4xxx – The addition of silicon to aluminum reduces melting temperature and improves fluidity. Silicon alone in aluminum produces a nonheat-treatable alloy; however, in combination with magnesium it produces a precipitation hardening heat-treatable alloy. Consequently, there are both heat-treatable and nonheat-treatable alloys within the 4xxx series. Silicon additions to aluminum are commonly used for the manufacturing of castings. The most common applications for the 4xxx series alloys are filler wires for fusion welding and brazing of aluminum.

Magnesium (Mg) 5xxx - The addition of magnesium to aluminum increases strength through solid solution strengthening and improves their strain hardening ability. These alloys are the highest strength nonheat-treatable aluminum alloys and are, therefore, used extensively for structural applications. The 5xxx series alloys are produced mainly as sheet and plate and only occasionally as extrusions. The reason for this is that these alloys strain harden quickly and, are, therefore difficult and expensive to extrude. Some common applications for the 5xxx series alloys are truck and train bodies, buildings, armored vehicles, ship and boat building, chemical tankers, pressure vessels and cryogenic tanks.

Magnesium and Silicon (Mg_2Si) 6xxx – The addition of magnesium and silicon to aluminum produces the compound magnesium-silicide (Mg_2Si). The formation of this compound provides the 6xxx series their heat-treatability. The 6xxx series alloys are easily and economically extruded and for this reason are most often found in an extensive selection of extruded shapes. These alloys form an important complementary system

with the 5xxx series alloy. The 5xxx series alloy used in the form of plate and the 6xxx are often joined to the plate in some extruded form. Some of the common applications for the 6xxx series alloys are handrails, drive shafts, automotive frame sections, bicycle frames, tubular lawn furniture, scaffolding, stiffeners and braces used on trucks, boats and many other structural fabrications.

Zinc (Zn) 7xxx – The addition of zinc to aluminum (in conjunction with some other elements, primarily magnesium and/or copper) produces heat-treatable aluminum alloys of the highest strength. The zinc substantially increases strength and permits precipitation hardening. Some of these alloys can be susceptible to stress corrosion cracking and for this reason are not usually fusion welded. Other alloys within this series are often fusion welded with excellent results. Some of the common applications of the 7xxx series alloys are aerospace, armored vehicles, baseball bats and bicycle frames.

Iron (Fe) – Iron is the most common impurity found in aluminum and is intentionally added to some pure (1xxx series) alloys to provide a slight increase in strength.

Chromium (Cr) – Chromium is added to aluminum to control grain structure, to prevent grain growth in aluminum-magnesium alloys, and to prevent recrystallization in aluminum-magnesium-silicon or aluminum-magnesium-zinc alloys during heat treatment. Chromium will also reduce stress corrosion susceptibility and improves toughness.

Nickel (Ni) – Nickel is added to aluminum-copper and to aluminum-silicon alloys to improve hardness and strength at elevated temperatures and to reduce the coefficient of expansion.

Titanium (Ti) – Titanium is added to aluminum primarily as a grain refiner. The grain refining effect of titanium is enhanced if boron is present in the melt or if it is added as a master alloy containing boron largely combined as TiB_2. Titanium is a common addition to aluminum weld filler wire as it refines the weld structure and helps to prevent weld cracking.

Zirconium (Zr) – Zirconium is added to aluminum to form a fine precipitate of intermatallic particles that inhibit recrystallization.

Lithium (Li) - The addition of lithium to aluminum can substantially increase strength and, Young's modulus, provide precipitation hardening and decreases density.

Lead (Pb) and Bismuth (Bi) – Lead and bismuth are added to aluminum to assist in chip formation and improve machinability. These free machining alloys are often not weldable because the lead and bismuth produce low melting constituents and can produce poor mechanical properties and/or high crack sensitivity on solidification.

Material Accounting Calculations
See the NPRI supporting information for process flow charts and detailed calculations.

The total quantity of manganese used in 2011 was calculated based on the type of alloy used and the average manganese content of each alloy. This mass balance gives the input quantity for the facility.

The data quality is considered average as it is based on a number of methods. The input quantities are based on average composition for each alloy type. Similarly the quantity contained in product is based on average composition for each alloy type.

Quantity emitted to air from the dross baghouse and the cutsaw baghouse is based on source testing while the quantity emitted from the incinerator baghouse is based on a calculated used in the ESDM report.

Dross is shipped off site for disposal. The quantity of manganese is calculated based on the average composition of dross.

Aluminum dust recovered from the incinerator baghouse is sent offsite for recovery. The quantity of manganese is calculated based on average composition.

It is considered that the inputs and outputs are approximately equal.

3.0 Estimated Direct and Indirect Costs

Manganese is found in the alloy used. As the manganese used is essential to the finished product, there are no options to reduce the usage. Hence the current cost of using manganese is not used in any economic feasibility and analysis and at this time has not been quantified. If a technically feasible option is found, the cost of using manganese will be developed for use in the economic analysis.

4.0 Identification of Options for Reduction in Usage of Manganese

The following options were identified to reduce the usage of manganese.

Category	Description
Material substitution/Process modification	Option 1: Use metal alloys that are manganese-free. This option would result in the reduction in use of of manganese or %, reduction of or % contained in product and reduction in kg or % sent offsite for recycling. As the facility is a recycling plant, it does not have control over the content of raw materials. Option 2: Use metal alloys with lower manganese content. Reductions will be dependent upon the reduction achieved. As the facility is a recycling plant, it does not have control over the content of raw materials.
Product Design	The product specifications are provided by the customer and SAPA has no control over the process. Furthermore, SAPA is an aluminum processing facility and does not have the ability to substitute different materials in the final product. Hence there is no option available in this category.
Spill and leak prevention	The toxic substance is a solid contained in a metal alloy and hence there is no potential for a spill or leak. All waste material is recycled on-site.
Reuse or recycling	All metal waste is currently collected and recycled on-site and hence there is no additional option available in this category.
Inventory management	The facility is a recycling plant and hence inventory management is not applicable. All waste material is recycled.
Training	The usage of manganese in the facility is independent of operator control. Hence there are no options available in this category.

5.0 Analysis 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

The results are recorded in the following table:

Option	Technical Feasibility	Feasible
Option 1: Use metal alloys that are manganese-free.	Alloys used as raw materials are scrap that is being recycled on-site. The facility does not have control over the composition os the scrap received.	No
Option 2: Use metal alloys with lower manganese content	Alloys used as raw materials are scrap that is being recycled on-site. The facility does not have control over the composition os the scrap received.	No

6.0 Implementation of Options

Due to customer requirements, there are no technically feasible options available to reduce the use of manganese. Hence there are no objectives to reduce the usage of manganese.

7.0 Planner Recommendations

As the planner has worked with the facility throughout the development of the plan, any suggestions to improve the plan have been incorporated into the document. Thus, there are no further recommendations at this time.

8.0 Certification

As of December 12, 2013, I, Yong Lee, certify that I have read the toxic substance reduction plan for manganese 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 with the exception of the regulatory deadline.

Yong Lee, General Manager

Date

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December 13, 2013

Wendy Nadan, Toxic Substance Reduction Planner

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December 13, 2013

Wendy Nadan, Toxic Substance Reduction Planner

Date

Toxics Reduction Plan
Particulate Matter

Prepared by:

SAPA Canada Inc.
7 Alloy Court
Toronto, ON
M9M 3A2

December 2013

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Statement of Intent

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Objective
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1.0 Facility Information

Toxic Substance	Particulate matter, PM10, PM2.5
CAS#	n/a
Number of full-time equivalent employees	53
NAICS	331529 Non-Ferrous Foundries
NPRI ID	1480
UTM NAD83 coordinates (entrance)	618318, 4843577

Canadian Parent Company

Legal name	n/a
Street address	n/a
% owned by parent	n/a
CCRA business number	n/a

Contact info

Owner and operator of facility	SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2
Highest ranking employee	Yong Lee General Manager SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 yong.lee@sapagroup.com
Person who coordinated preparation of plan	Michael Zorayan SAPA Canada Inc.

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Planner	
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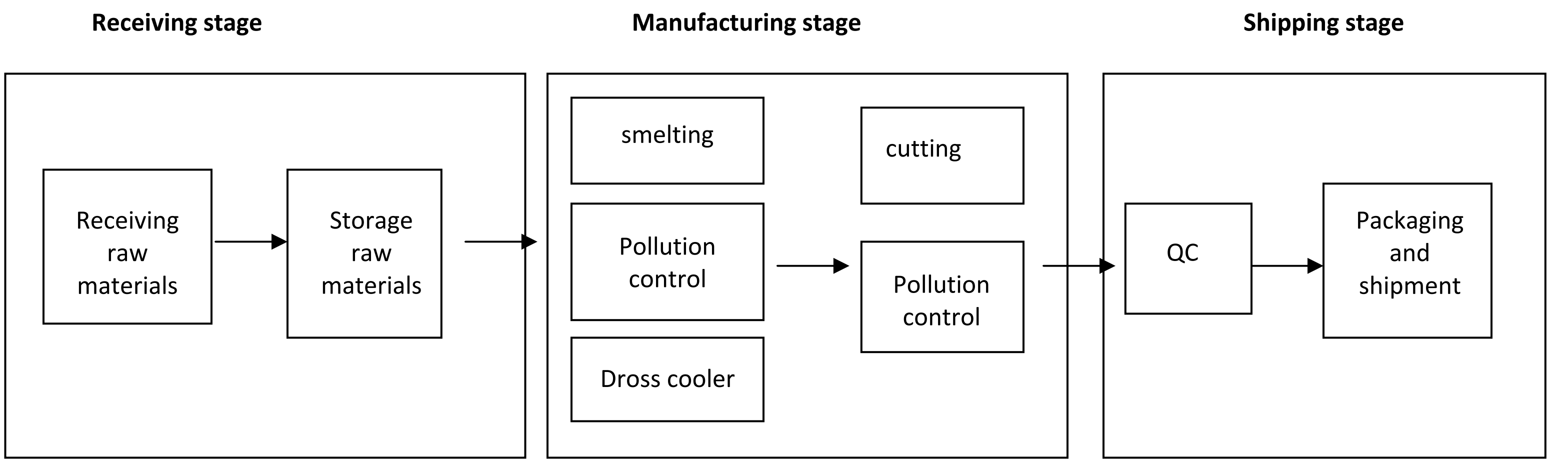
2.0 Identification of Stages and Processes



Manufacturing processes
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The scrap furnace operates at a roof temperature of approx.920C with the incinerator operating at 1015C to destroy organic matter and minimise formation of dioxans and furans.

Clean scrap and sows are melted in separate furnaces that operate at a roof temperature of 795C. Once the metal is molten, it is sent to a holding furnace. From the holding furnace, the molten metal is sent to the casting unit and homogeniser. The metal is held in the furnace for approximately 30 minutes until the target temperature has been attained and is then sent to the casting unit for immediate pouring. The homogenizer operates at approx. 595C which allows components (primarily silicon and manganese) to disperse in the solid phase rather than accumulate. Once cooled, the metal is sawn into billets and shipped to customers. There are 4 to 6 pours per 12 hour shift.

Particulate matter is not a raw material in the process rather it is created in the gas stream from the furnaces and incinerator and from the sawing process.

Material Accounting Calculations
See the NPRI supporting information for process flow charts and detailed calculations.

The data quality is considered average as it is based on a number of methods.

There is no particulate matter used in the facility. PM is created as a by product of smelting, incineration, combustion of natural gas and sawing.

The quantity emitted to air from the holding furnace and furnaces 2 and 3 is assumed to be the same as the quantity created.

The quantity emitted to air from the dross baghouse and the cutsaw baghouse is based on source testing while the quantity emitted from the incinerator baghouse is based on a calculation used in the ESDM report. The quantity of particulate matter generated by furnace 4, the dross cooler and the saw is unknown.

Aluminum dust recovered from the incinerator baghouse is sent offsite for recovery.

It is considered that the inputs and outputs are approximately equal since inputs (creation) are calculated based on outputs.

3.0 Estimated Direct and Indirect Costs

Particulate matter is created during combustion, sawing and smelting. As they are unwanted byproducts inherent to the process, there are no options to reduce the creation. Hence the current cost of creation is not used in any economic feasibility and analysis and at this time has not been quantified. If a technically feasible option is found, the cost of creation will be developed for use in the economic analysis.

4.0 Identification of Options for Reduction in Creation of Particulate matter

The following options were identified to reduce the creation of particulate matter.

Category	Description
Material substitution	Option #1: Eliminate scrap aluminum from the raw material stream, reducing the need for an incinerator and associated baghouse. This would reduce creation and air emissions by 514kg or 1%.
Product design	Option #2: Alloys can be supplied to customers as raw ingots without sawing. This would reduce creation and air emissions by 907kg or 2%.
Process modification	Option #3: Install HEPA filters on baghouses. This will reduce air emissions by 2,646kg or 7%.
Spill and leak prevention	Option #4: Implement a preventative maintenance program on baghouses to ensure optimum performance. An annual PM program has already been implemented so this option will not be pursued further.
Reuse or recycling	Option #5: recycle baghouse particulate matter into the furnaces. The shavings from the saws are currently recycled into the furnace.
Inventory management	Particulate matter is not an input into the process and hence there is no option in this category.
Training	The melting and casting process is highly automated and operators have little flexibility to change process parameters. Operators have no control over the composition of raw materials. Therefore there is no training option available.

5.0 Analysis 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

The results are recorded in the following table:

Option	Technical Feasibility	Feasible
Option #1: Eliminate contaminated scrap	The purpose of the facility is to recycle used and painted aluminum. Hence, eliminating this function would cause other effects that have a negative environmental impact ie necessitate greater use of virgin aluminum which causes air emissions and uses large amounts of energy in the smelting process.	No
Option #2: Eliminate sawing	Customers require the cast aluminum to be supplied in a size suitable for their equipment. Therefore this option is not technically feasible due to customer requirements.	No
Option #3: Install HEPA filters on all baghouses	HEPA filters are available in the market place and are used by multiple industry sectors. However vendors have been unable to identify a filter that will work with processes in the facility.	No

6.0 Economic Feasibility

As there are no technically feasible options, no economic feasibility is necessary.

7.0 Implementation of Options

There are no technically feasible options and hence no option to implement.

8.0 Planner Recommendations

As the planner has worked with the facility throughout the development of the plan, any suggestions to improve the plan have been incorporated into the document. One further recommendation is made however:

- If technically feasible options are identified, develop the total cost of creating particulate matter.

9.0 Certification

As of December 12, 2013, I, Yong Lee, certify that I have read the toxic substance reduction plan for particulate matter 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.

Yong Lee, General Manager

Date

As of December 13, 2013, I, Wendy Nadan certify that I am familiar with the processes at SAPA Canada Inc. that use particulate matter, 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 December 13, 2013 and that the plan complies with that Act and Ontario Regulation 455/09 (General) made under that Act.

December 13, 2013

Wendy Nadan, Toxic Substance Reduction Planner

Date

9.0 Certification

As of December 12, 2013, I, Yong Lee, certify that I have read the toxic substance reduction plan for particulate matter 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.

Yong Lee, General Manager — Date: Dec. 23, 2014.

As of December 13, 2013, I, Wendy Nadan certify that I am familiar with the processes at SAPA Canada Inc. that use particulate matter, 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 December 13, 2013 and that the plan complies with that Act and Ontario Regulation 455/09 (General) made under that Act.

December 13, 2013

Wendy Nadan, Toxic Substance Reduction Planner — Date

Toxics Reduction Plan

Nitrogen Oxides

Prepared by:

SAPA Canada Inc.
7 Alloy Court
Toronto, ON
M9M 3A2

February 2018

Contents

Statement of Intent

SAPA is committed to reducing the environmental impact of its manufacturing operations by implementing the principle of pollution prevention in daily activities. Key activities include continually seeking ways to reduce the creation of toxic substances.

Objective

SAPA will continue to explore new technologies with the goal of reducing use of toxic substances. As new technologies become available, SAPA will explore the economic feasibility to determine which options will be implemented.

1.0 Facility Information

Toxic Substances	Nitrogen Oxides
CAS#	11104-93-1
Number of full-time equivalent employees	53
NAICS	331529 Non-Ferrous Foundries
NPRI ID	1480
UTM NAD83 coordinates (entrance)	618318, 4843577

Canadian Parent Company

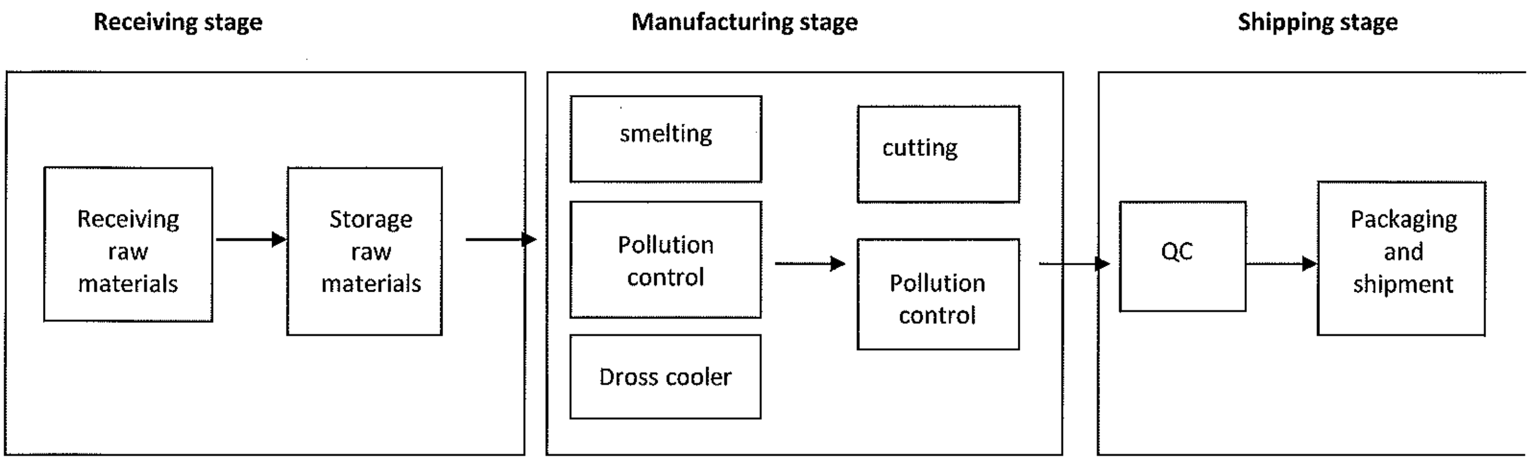
Legal name	n/a
Street address	n/a
% owned by parent	n/a
CCRA business number	n/a

Contact info

Owner and operator of facility	SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2
Highest ranking employee	David Reid Plant Manager SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 David.reid@hydro.com
Person who coordinated preparation of plan	Kate McCallum SAPA Canada Inc.

	7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 kate.mccallum@hydro.com
Person who prepared plan	Wendy Nadan Nadan Consulting Ltd 151 Montgomery Blvd Orangeville ON L9W 5C1 519 940 4724 wendy@nadanconsulting.com
Public contact	Kate McCallum SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 kate.mccallum@hydro.com
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 TRSP 0092

2.0 Identification of Stages and Processes



Manufacturing processes
The SAPA casthouse receives used aluminum for recycling as well as sows and clean scrap that are used as raw materials in the smelting process. Contaminated scrap is placed in a separate furnace that volatilizes contaminants and sends them to an incinerator for destruction. The emissions from the incinerator are routed through a baghouse to collect particulate matter.

The scrap furnace operates at a roof temperature of approx. 920C with the incinerator operating at 1015C to destroy organic matter and minimise formation of dioxans, furans and hexachlorobenzene.

Clean scrap and sows are melted in separate furnaces that operate at a roof temperature of 795C. Once the metal is molten, it is sent to a holding furnace. From the holding furnace, the molten metal is sent to the casting unit and homogeniser. The metal is held in the furnace for approximately 30 minutes until the target temperature has been attained and is then sent to the casting unit for immediate pouring. The homogenizer operates at approx. 595C which allows components (primarily silicon and manganese) to disperse in the solid phase rather than accumulate. Once cooled, the metal is sawn into billets and shipped to customers. There are 4 to 6 pours per 12 hour shift.

The gases from the scrap furnace are sent to an incinerator for destruction of the dioxins, furans and hexachlorobenzene. The gas stream from the incinerator is subject to lime injection which reacts with the dioxins, furans and hexachlorobenzenes, neutralising and destroying them. The lime is collected in a baghouse in which the bags are also coated with lime.

There are two 35 ton furnaces with a melting capacity of 35 tons and an incinerator furnace connected to a baghouse with a melting capacity of 8 tons. A batch takes 2-3 hours before transfer to the homogeniser. The furnaces operate 24/7 except for shutdowns at Xmas and New Years.

The furnaces have a gate at the front that is opened for loading. Aluminum is loaded using front end loaders with buckets. Once charged, the gate is closed and it remains closed while the batch is heated. The homogeniser has a gate at the front which is kept open for safety reasons while molten metal is transferred in.

There is one homogeniser with an 80 ton capacity that operates on an 8 hour cycle with a 3 hour cool down.

Heat ie energy is lost while the furnace is opened for charging. The furnaces are equipped with themocouples to prevent overheating.

Basic natural gas or oil-fired reverberatory furnaces range in efficiencies from approximately 20 to 45%. The more efficient furnaces employ recuperation of stack gas heat for reduced melting energy requirements through charge preheating or for more efficient burner operation through preheating combustion air. Furnace condition and operating practices have large effects on energy performance. Because heat transfer in reverberatory furnaces takes place principally through radiation, melt surface temperatures are considerably hotter, leading to more rapid oxidation and higher melt losses. The melting furnaces do not preheat the charge but do preheat combustion air to recover heat.

Reverberatory furnaces are box-shaped and consist of an insulated steel shell with a refractory lining (a heat resistant material). Fuel-fired reverberatory furnaces are used when the melt rate and/or capacity are large. The fuel-fired reverberatory furnace fires natural gas, propane, or oil directly into the furnace from either the roof or, more typically, the sidewall. The heat is transferred to the surface of the molten aluminum predominantly by refractory radiation and some convection. There are a large number of reverberatory furnace design variations: charging and access doors, refractory specifications, sidewells for charging and/or recirculation, hearth or sidewall induction stirring, split hearths, dry hearths, divided zones for melting and holding, and various burner capacities and types. Recuperation concepts include charge preheating, preheating combustion air, and cogeneration.

Oxide naturally and rapidly forms on the surface of molten aluminum, resulting initially in a thin protective film. With increase in time and temperature, the thickness of the oxide layer increases. Turbulence and agitation accelerate oxide formation and result in the intermixing of metal and oxides. Oxidation rates are influenced by alloy content and increase with temperature, especially when magnesium is present in the alloy. The oxide layer also effectively insulates the bath from radiation heat transfer and must be periodically removed to maintain thermal efficiency in reverberatory furnaces.

Fluxes are employed to treat the skim before it is removed from the furnace, the oxides are typically dewet, and a large portion of the molten aluminum entrained in the skim layer separates to the melt. In either case, untreated (skim) or flux-treated (dross) contains entrained free metal as a result of the skimming action. Efforts are usually made to recover entrained free aluminum after skimming. While still hot, metal can be drained from the skim gravimetrically and with vibration. Alternatively, skim may be rapidly cooled by inert-gas quenching or in rotating water-cooled steel drums, after which free aluminum may be physically separated. The residue comprising unrecovered aluminum and oxides is normally further processed for its metal content.

Skim is cooled rapidly in the dross processor to prevent thermiting (spontaneous combustion in air) and thus prevent metal loss. Any metal lost represents energy expended for no final product and thus lost efficiency.

Material Accounting Calculations

See the NPRI supporting information for process flow charts and detailed calculations.

The emission of oxides of nitrogen is calculated based on published emission factors. Data quality is therefore considered above average.

3.0 Estimated Direct and Indirect Costs

Oxides of nitrogen are created during the combustion of natural gas.

Cost of natural gas used in 2015 $1,325,327.82

4.0 Identification of Options for Reduction in Creation of Nitrogen oxides

The following options were identified to reduce the creation of nitrogen oxides.

Category	Description
Material substitution	As NOx is an unwanted byproduct there is no material substitution available.
Product design	Product supplied to the customer is a raw material into an extrusion process. The billets produced have no impact on the creation of nitrogen oxides.
Process modification	Option #1: Process heat can be recuperated and used for charge preheating Option #2: Immersion heating of charge with high high watt density elements Option #3: Improved skim handling
Spill and leak prevention	There is a regular program for detecting leaks of natural gas. As all the NOx created is emitted to air, by definition all the NOX is spilled or leaked to air so there is no option for this category.
Reuse or recycling	Oxides of nitrogen cannot be reused or recycled as they are an unwanted by product of the process.
Inventory management	Oxides of nitrogen are not part of the input stream and are targeted for destruction in the process therefore there is no inventory to manage.
Training	The melting and casting process is highly automated and operators have little flexibility to change process parameters. Therefore there is no training option available.

5.0 Analysis 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

The results are recorded in the following table:

Option	Technical Feasibility	Feasible
Option #1: recover heat	Heat is already being recovered and used to pre heat combustion air and hence this option is not technically feasible	No
Option #2: immersion heating	This technique is experimental and not yet fully tested for full scale use. It would switch energy use from gas to electricity and since Ontario generates only approximately 35% of electricity using natural gas, would result in lower and indirect emissions.	No
Option #3: skim	Skim handling techniques have been optimized to	No

handling	minimize/eliminate thermiting	

6.0 Economic Feasibility

As there are no technically feasible options, no economic feasibility is necessary.

7.0 Implementation of Options

There are no technically feasible options available to reduce the creation of nitrogen oxides. Hence there are no objectives to reduce the creation of nitrogen oxides.

8.0 Planner Recommendations

As the planner has worked with the facility throughout the development of the plan, any suggestions to improve the plan have been incorporated into the document. Thus, there are no further recommendations at this time.

9.0 Certification

As of February 20, 2018 I, David Reid, certify that I have read the toxic substance reduction plan for oxides of nitrogen 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 with the exception of the regulatory deadline.

David Reid, Plant Manager

February 20th 2018
Date

As of February 20, 2018, I, Wendy Nadan certify that I am familiar with the processes at SAPA Canada Inc. that create oxides of nitrogen, 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 February 2018 and that the plan complies with that Act and Ontario Regulation 455/09 (General) made under that Act with the exception of the regulatory deadline.

February 20, 2018

Wendy Nadan, Toxic Substance Reduction Planner

Date

Toxics Reduction Plan
Chromium

Prepared by:

SAPA Canada Inc.
7 Alloy Court
Toronto, ON
M9M 3A2

December 2013

Contents

Statement of Intent

SAPA is committed to reducing the environmental impact of its manufacturing operations by implementing the principle of pollution prevention in daily activities. Key activities include continually seeking ways to reduce the usage of toxic substances.

Objective

SAPA will continue to explore new technologies with the goal of reducing use of toxic substances. As new technologies become available, SAPA will explore the economic feasibility to determine which options will be implemented.

1.0 Facility Information

Toxic Substance	Chromium
CAS#	7440-47-3
Number of full-time equivalent employees	53
NAICS	331529 Non-Ferrous Foundries
NPRI ID	1480
UTM NAD83 coordinates (entrance)	618318, 4843577

Canadian Parent Company

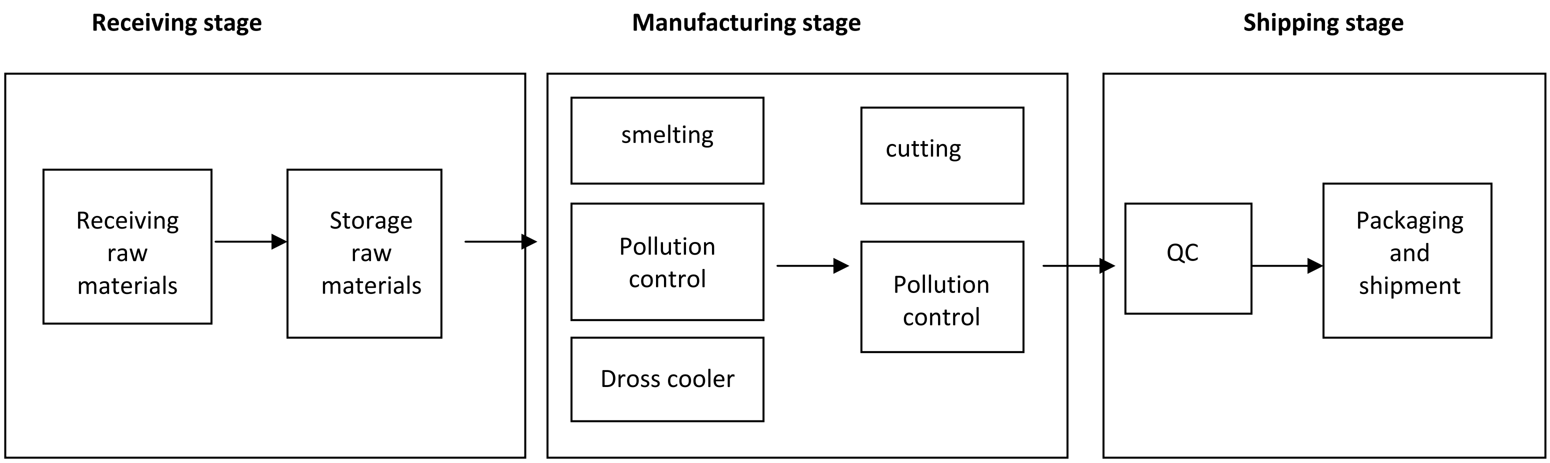
Legal name	n/a
Street address	n/a
% owned by parent	n/a
CCRA business number	n/a

Contact info

Owner and operator of facility	SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2
Highest ranking employee	Yong Lee General Manager SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 yong.lee@sapagroup.com
Person who coordinated preparation of plan	Michael Zorayan SAPA Canada Inc.

	7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 michael.zorayan@sapagroup.com
Person who prepared plan	Wendy Nadan Nadan Consulting Ltd 151 Montgomery Blvd Orangeville ON L9W 5C1 519 940 4724 wendy@nadanconsulting.com
Public contact	Michael Zorayan SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 michael.zorayan@sapagroup.com
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 TRSP 0092

2.0 Identification of Stages and Processes



Manufacturing processes

The SAPA casthouse receives used aluminum for recycling as well as sows and clean scrap that are used as raw materials in the smelting process. Contaminated scrap is placed in a separate furnace that volatilizes contaminants and sends them to an incinerator for destruction. The emissions from the incinerator are routed through a baghouse to collect particulate matter.

The scrap furnace operates at a roof temperature of approx.920C with the incinerator operating at 1015C to destroy organic matter and minimise formation of dioxans and furans.

Clean scrap and sows are melted in separate furnaces that operate at a roof temperature of 795C. Once the metal is molten, it is sent to a holding furnace. From the holding furnace, the molten metal is sent to the casting unit and homogeniser. The metal is held in the furnace for approximately 30 minutes until the target temperature has been attained and is then sent to the casting unit for immediate pouring. The homogenizer operates at approx. 595C which allows components (primarily silicon and manganese) to disperse in the solid phase rather than accumulate. Once cooled, the metal is sawn into billets and shipped to customers. There are 4 to 6 pours per 12 hour shift.

Other metals are required in the aluminum to provide specific properties. It would be very unusual to find pure aluminum (1xxx series of alloys) chosen for structural fabrication because of their strength characteristics. Although the 1xxx series are almost pure aluminum, they will respond to strain hardening and especially so if they contain appreciable amounts of impurities such as iron and silicon. However, even in the strain-hardened condition, the 1xxx series alloys have very low strength when compared to the other series of aluminum alloys. When the 1xxx series alloys are chosen for a structural application, they are most often chosen for their superior corrosion resistance and/or their high electrical conductivity. The most common applications for the 1xxx series alloys are aluminum foil, electrical buss bars, metallizing wire and chemical tanks and piping systems.

The addition of alloying elements to aluminum is the principal method used to produce a selection of different materials that can be used in a wide assortment of structural applications.

Series	*Primary Alloying Element*
1xxx	Aluminum - 99.00% or Greater
2xxx	Copper
3xxx	Manganese
4xxx	Silicon
5xxx	Magnesium
6xxx	Magnesium and Silicon
7xxx	Zinc

The principal effects of alloying elements in aluminum are as follows:

Copper (Cu) 2xxx – The aluminum-copper alloys typically contain between 2 to 10% copper, with smaller additions of other elements. The copper provides substantial increases in strength and facilitates precipitation hardening. The introduction of copper to aluminum can also reduce ductility and corrosion resistance. The susceptibility to solidification cracking of aluminum-copper alloys is increased; consequently, some of these alloys can be the most challenging aluminum alloys to weld. These alloys include some of the highest strength heat treatable aluminum alloys. The most common applications for the 2xxx series alloys are aerospace, military vehicles and rocket fins.

Manganese (Mn) 3xxx – The addition of manganese to aluminum increases strength somewhat through solution strengthening and improves strain hardening while not appreciably reducing ductility or corrosion resistance. These are moderate strength nonheat-treatable materials that retain strength at elevated temperatures and are seldom used for major structural applications. The most common applications for the 3xxx series alloys are cooking utensils, radiators, air conditioning condensers, evaporators, heat exchangers and associated piping systems.

Silicon (Si) 4xxx – The addition of silicon to aluminum reduces melting temperature and improves fluidity. Silicon alone in aluminum produces a nonheat-treatable alloy; however, in combination with magnesium it produces a precipitation hardening heat-treatable alloy. Consequently, there are both heat-treatable and nonheat-treatable alloys within the 4xxx series. Silicon additions to aluminum are commonly used for the manufacturing of castings. The most common applications for the 4xxx series alloys are filler wires for fusion welding and brazing of aluminum.

Magnesium (Mg) 5xxx - The addition of magnesium to aluminum increases strength through solid solution strengthening and improves their strain hardening ability. These alloys are the highest strength nonheat-treatable aluminum alloys and are, therefore, used extensively for structural applications. The 5xxx series alloys are produced mainly as sheet and plate and only occasionally as extrusions. The reason for this is that these alloys strain harden quickly and, are, therefore difficult and expensive to extrude. Some common applications for the 5xxx series alloys are truck and train bodies, buildings, armored vehicles, ship and boat building, chemical tankers, pressure vessels and cryogenic tanks.

Magnesium and Silicon (Mg_2Si) 6xxx – The addition of magnesium and silicon to aluminum produces the compound magnesium-silicide (Mg_2Si). The formation of this compound provides the 6xxx series their heat-treatability. The 6xxx series alloys are easily and economically extruded and for this reason are most often found in an extensive selection of extruded shapes. These alloys form an important complementary system

with the 5xxx series alloy. The 5xxx series alloy used in the form of plate and the 6xxx are often joined to the plate in some extruded form. Some of the common applications for the 6xxx series alloys are handrails, drive shafts, automotive frame sections, bicycle frames, tubular lawn furniture, scaffolding, stiffeners and braces used on trucks, boats and many other structural fabrications.

Zinc (Zn) 7xxx – The addition of zinc to aluminum (in conjunction with some other elements, primarily magnesium and/or copper) produces heat-treatable aluminum alloys of the highest strength. The zinc substantially increases strength and permits precipitation hardening. Some of these alloys can be susceptible to stress corrosion cracking and for this reason are not usually fusion welded. Other alloys within this series are often fusion welded with excellent results. Some of the common applications of the 7xxx series alloys are aerospace, armored vehicles, baseball bats and bicycle frames.

Iron (Fe) – Iron is the most common impurity found in aluminum and is intentionally added to some pure (1xxx series) alloys to provide a slight increase in strength.

Chromium (Cr) – Chromium is added to aluminum to control grain structure, to prevent grain growth in aluminum-magnesium alloys, and to prevent recrystallization in aluminum-magnesium-silicon or aluminum-magnesium-zinc alloys during heat treatment. Chromium will also reduce stress corrosion susceptibility and improves toughness.

Nickel (Ni) – Nickel is added to aluminum-copper and to aluminum-silicon alloys to improve hardness and strength at elevated temperatures and to reduce the coefficient of expansion.

Titanium (Ti) – Titanium is added to aluminum primarily as a grain refiner. The grain refining effect of titanium is enhanced if boron is present in the melt or if it is added as a master alloy containing boron largely combined as TiB_2. Titanium is a common addition to aluminum weld filler wire as it refines the weld structure and helps to prevent weld cracking.

Zirconium (Zr) – Zirconium is added to aluminum to form a fine precipitate of intermatallic particles that inhibit recrystallization.

Lithium (Li) - The addition of lithium to aluminum can substantially increase strength and, Young's modulus, provide precipitation hardening and decreases density.

Lead (Pb) and Bismuth (Bi) – Lead and bismuth are added to aluminum to assist in chip formation and improve machinability. These free machining alloys are often not weldable because the lead and bismuth produce low melting constituents and can produce poor mechanical properties and/or high crack sensitivity on solidification.

Material Accounting Calculations
See the NPRI supporting information for process flow charts and detailed calculations.

The total quantity of chromium used in 2011 was calculated based on the type of alloy used and the average chromium content of each alloy. This mass balance gives the input quantity for the facility.

The data quality is considered average as it is based on a number of methods. The input quantities are based on average composition for each alloy type. Similarly the quantity contained in product is based on average composition for each alloy type.

Quantity emitted to air from the dross baghouse and the cutsaw baghouse is based on source testing while the quantity emitted from the incinerator baghouse is based on a calculated used in the ESDM report.

Dross is shipped off site for disposal. The quantity of chromium is calculated based on the average composition of dross.

Aluminum dust recovered from the incinerator baghouse is sent offsite for recovery. The quantity of chromium is calculated based on average composition.

It is considered that the inputs and outputs are approximately equal.

3.0 Estimated Direct and Indirect Costs

Chromium is found in the alloy used. As the chromium used is essential to the finished product, there are no options to reduce the usage. Hence the current cost of using chromium is not used in any economic feasibility and analysis and at this time has not been quantified. If a technically feasible option is found, the cost of using chromium will be developed for use in the economic analysis.

4.0 Identification of Options for Reduction in Usage of Chromium

The following options were identified to reduce the usage of chromium.

Category	Description
Material substitution/Process modification	Option 1: Use metal alloys that are chromium-free. This option would result in the reduction in use of chromium or %, reduction of or % contained in product and reduction in kg or % sent offsite for recycling. As the facility is a recycling plant, it does not have control over the content of raw materials. Option 2: Use metal alloys with lower chromium content. Reductions will be dependent upon the reduction achieved. As the facility is a recycling plant, it does not have control over the content of raw materials.
Product Design	The product specifications are provided by the customer and SAPA has no control over the process. Furthermore, SAPA is an aluminum processing facility and does not have the ability to substitute different materials in the final product. Hence there is no option available in this category.
Spill and leak prevention	The toxic substance is a solid contained in a metal alloy and hence there is no potential for a spill or leak. All waste material is recycled on-site.
Reuse or recycling	All metal waste is currently collected and recycled on-site and hence there is no additional option available in this category.
Inventory management	The facility is a recycling plant and hence inventory management is not applicable. All waste material is recycled.
Training	The usage of chromium in the facility is independent of operator control. Hence there are no options available in this category.

5.0 Analysis 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

The results are recorded in the following table:

Option	Technical Feasibility	Feasible
Option 1: Use metal alloys that are chromium-free.	Alloys used as raw materials are scrap that is being recycled on-site. The facility does not have control over the composition of the scrap received.	No
Option 2: Use metal alloys with lower chromium content	Alloys used as raw materials are scrap that is being recycled on-site. The facility does not have control over the composition of the scrap received.	No

6.0 Implementation of Options

Due to customer requirements, there are no technically feasible options available to reduce the use of chromium. Hence there are no objectives to reduce the usage of chromium.

7.0 Planner Recommendations

As the planner has worked with the facility throughout the development of the plan, any suggestions to improve the plan have been incorporated into the document. Thus, there are no further recommendations at this time.

8.0 Certification

As of December 12, 2013, I, Yong Lee, certify that I have read the toxic substance reduction plan for chromium 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 with the exception of the regulatory deadline.

Yong Lee, General Manager — Date

As of December 13, 2013, I, Wendy Nadan certify that I am familiar with the processes at SAPA Canada Inc. that use chromium, 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 December 13, 2013 and that the plan complies with that Act and Ontario Regulation 455/09 (General) made under that Act with the exception of the regulatory deadline.

December 13, 2013

Wendy Nadan, Toxic Substance Reduction Planner — Date

8.0 Certification

As of December 12, 2013, I, Yong Lee, certify that I have read the toxic substance reduction plan for chromium 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 with the exception of the regulatory deadline.

Yong Lee, General Manager — Dec. 23, 2013 (Date)

As of December 13, 2013, I, Wendy Nadan certify that I am familiar with the processes at SAPA Canada Inc. that use chromium, 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 December 13, 2013 and that the plan complies with that Act and Ontario Regulation 455/09 (General) made under that Act with the exception of the regulatory deadline.

Wendy Nadan, Toxic Substance Reduction Planner — December 13, 2013 (Date)

Toxics Reduction Plan
Copper

Prepared by:

SAPA Canada Inc.
7 Alloy Court
Toronto, ON
M9M 3A2

December 2013

Contents

Statement of Intent

SAPA is committed to reducing the environmental impact of its manufacturing operations by implementing the principle of pollution prevention in daily activities. Key activities include continually seeking ways to reduce the usage of toxic substances.

Objective

SAPA will continue to explore new technologies with the goal of reducing use of toxic substances. As new technologies become available, SAPA will explore the economic feasibility to determine which options will be implemented.

1.0 Facility Information

Toxic Substance	Copper
CAS#	7440-50-8
Number of full-time equivalent employees	53
NAICS	331529 Non-Ferrous Foundries
NPRI ID	1480
UTM NAD83 coordinates (entrance)	618318, 4843577

Canadian Parent Company

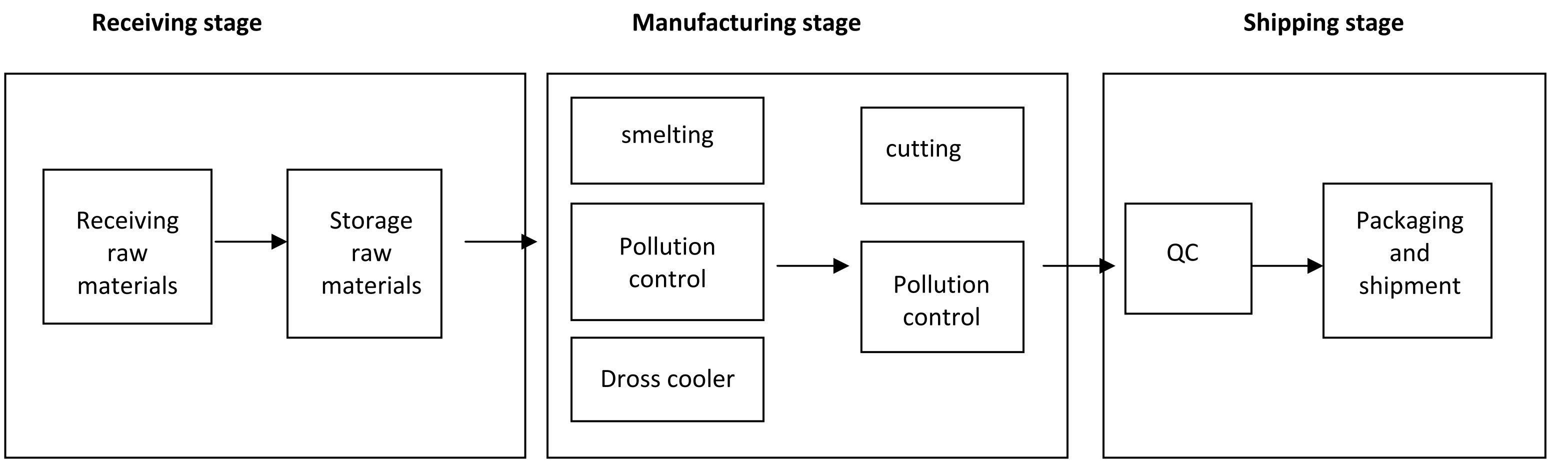
Legal name	n/a
Street address	n/a
% owned by parent	n/a
CCRA business number	n/a

Contact info

Owner and operator of facility	SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2
Highest ranking employee	Yong Lee General Manager SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 yong.lee@sapagroup.com
Person who coordinated preparation of plan	Michael Zorayan SAPA Canada Inc.

	7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 michael.zorayan@sapagroup.com
Person who prepared plan	Wendy Nadan Nadan Consulting Ltd 151 Montgomery Blvd Orangeville ON L9W 5C1 519 940 4724 wendy@nadanconsulting.com
Public contact	Michael Zorayan SAPA Canada Inc. 7 Alloy Ct Toronto, ON M9M 3A2 (416) 743-1080 ext 5274 michael.zorayan@sapagroup.com
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 TRSP 0092

2.0 Identification of Stages and Processes



Manufacturing processes

The SAPA casthouse receives used aluminum for recycling as well as sows and clean scrap that are used as raw materials in the smelting process. Contaminated scrap is placed in a separate furnace that volatilizes contaminants and sends them to an incinerator for destruction. The emissions from the incinerator are routed through a baghouse to collect particulate matter.

The scrap furnace operates at a roof temperature of approx.920C with the incinerator operating at 1015C to destroy organic matter and minimise formation of dioxans and furans.

Clean scrap and sows are melted in separate furnaces that operate at a roof temperature of 795C. Once the metal is molten, it is sent to a holding furnace. From the holding furnace, the molten metal is sent to the casting unit and homogeniser. The metal is held in the furnace for approximately 30 minutes until the target temperature has been attained and is then sent to the casting unit for immediate pouring. The homogenizer operates at approx. 595C which allows components (primarily silicon and manganese) to disperse in the solid phase rather than accumulate. Once cooled, the metal is sawn into billets and shipped to customers. There are 4 to 6 pours per 12 hour shift.

Other metals are required in the aluminum to provide specific properties. It would be very unusual to find pure aluminum (1xxx series of alloys) chosen for structural fabrication because of their strength characteristics. Although the 1xxx series are almost pure aluminum, they will respond to strain hardening and especially so if they contain appreciable amounts of impurities such as iron and silicon. However, even in the strain-hardened condition, the 1xxx series alloys have very low strength when compared to the other series of aluminum alloys. When the 1xxx series alloys are chosen for a structural application, they are most often chosen for their superior corrosion resistance and/or their high electrical conductivity. The most common applications for the 1xxx series alloys are aluminum foil, electrical buss bars, metallizing wire and chemical tanks and piping systems.

The addition of alloying elements to aluminum is the principal method used to produce a selection of different materials that can be used in a wide assortment of structural applications.

Series	*Primary Alloying Element*
1xxx	Aluminum - 99.00% or Greater
2xxx	Copper
3xxx	Manganese
4xxx	Silicon
5xxx	Magnesium
6xxx	Magnesium and Silicon
7xxx	Zinc

The principal effects of alloying elements in aluminum are as follows:

Copper (Cu) 2xxx – The aluminum-copper alloys typically contain between 2 to 10% copper, with smaller additions of other elements. The copper provides substantial increases in strength and facilitates precipitation hardening. The introduction of copper to aluminum can also reduce ductility and corrosion resistance. The susceptibility to solidification cracking of aluminum-copper alloys is increased; consequently, some of these alloys can be the most challenging aluminum alloys to weld. These alloys include some of the highest strength heat treatable aluminum alloys. The most common applications for the 2xxx series alloys are aerospace, military vehicles and rocket fins.

Manganese (Mn) 3xxx – The addition of manganese to aluminum increases strength somewhat through solution strengthening and improves strain hardening while not appreciably reducing ductility or corrosion resistance. These are moderate strength nonheat-treatable materials that retain strength at elevated temperatures and are seldom used for major structural applications. The most common applications for the 3xxx series alloys are cooking utensils, radiators, air conditioning condensers, evaporators, heat exchangers and associated piping systems.

Silicon (Si) 4xxx – The addition of silicon to aluminum reduces melting temperature and improves fluidity. Silicon alone in aluminum produces a nonheat-treatable alloy; however, in combination with magnesium it produces a precipitation hardening heat-treatable alloy. Consequently, there are both heat-treatable and nonheat-treatable alloys within the 4xxx series. Silicon additions to aluminum are commonly used for the manufacturing of castings. The most common applications for the 4xxx series alloys are filler wires for fusion welding and brazing of aluminum.

Magnesium (Mg) 5xxx - The addition of magnesium to aluminum increases strength through solid solution strengthening and improves their strain hardening ability. These alloys are the highest strength nonheat-treatable aluminum alloys and are, therefore, used extensively for structural applications. The 5xxx series alloys are produced mainly as sheet and plate and only occasionally as extrusions. The reason for this is that these alloys strain harden quickly and, are, therefore difficult and expensive to extrude. Some common applications for the 5xxx series alloys are truck and train bodies, buildings, armored vehicles, ship and boat building, chemical tankers, pressure vessels and cryogenic tanks.

Magnesium and Silicon (Mg_2Si) 6xxx – The addition of magnesium and silicon to aluminum produces the compound magnesium-silicide (Mg_2Si). The formation of this compound provides the 6xxx series their heat-treatability. The 6xxx series alloys are easily and economically extruded and for this reason are most often found in an extensive selection of extruded shapes. These alloys form an important complementary system

with the 5xxx series alloy. The 5xxx series alloy used in the form of plate and the 6xxx are often joined to the plate in some extruded form. Some of the common applications for the 6xxx series alloys are handrails, drive shafts, automotive frame sections, bicycle frames, tubular lawn furniture, scaffolding, stiffeners and braces used on trucks, boats and many other structural fabrications.

Zinc (Zn) 7xxx – The addition of zinc to aluminum (in conjunction with some other elements, primarily magnesium and/or copper) produces heat-treatable aluminum alloys of the highest strength. The zinc substantially increases strength and permits precipitation hardening. Some of these alloys can be susceptible to stress corrosion cracking and for this reason are not usually fusion welded. Other alloys within this series are often fusion welded with excellent results. Some of the common applications of the 7xxx series alloys are aerospace, armored vehicles, baseball bats and bicycle frames.

Iron (Fe) – Iron is the most common impurity found in aluminum and is intentionally added to some pure (1xxx series) alloys to provide a slight increase in strength.

Chromium (Cr) – Chromium is added to aluminum to control grain structure, to prevent grain growth in aluminum-magnesium alloys, and to prevent recrystallization in aluminum-magnesium-silicon or aluminum-magnesium-zinc alloys during heat treatment. Chromium will also reduce stress corrosion susceptibility and improves toughness.

Nickel (Ni) – Nickel is added to aluminum-copper and to aluminum-silicon alloys to improve hardness and strength at elevated temperatures and to reduce the coefficient of expansion.

Titanium (Ti) – Titanium is added to aluminum primarily as a grain refiner. The grain refining effect of titanium is enhanced if boron is present in the melt or if it is added as a master alloy containing boron largely combined as TiB_2. Titanium is a common addition to aluminum weld filler wire as it refines the weld structure and helps to prevent weld cracking.

Zirconium (Zr) – Zirconium is added to aluminum to form a fine precipitate of intermatallic particles that inhibit recrystallization.

Lithium (Li) - The addition of lithium to aluminum can substantially increase strength and, Young's modulus, provide precipitation hardening and decreases density.

Lead (Pb) and Bismuth (Bi) – Lead and bismuth are added to aluminum to assist in chip formation and improve machinability. These free machining alloys are often not weldable because the lead and bismuth produce low melting constituents and can produce poor mechanical properties and/or high crack sensitivity on solidification.

Material Accounting Calculations

See the NPRI supporting information for process flow charts and detailed calculations.

The total quantity of copper used in 2011 was calculated based on the type of alloy used and the average copper content of each alloy. This mass balance gives the input quantity for the facility.

The data quality is considered average as it is based on a number of methods. The input quantities are based on average composition for each alloy type. Similarly the quantity contained in product is based on average composition for each alloy type.

Quantity emitted to air from the dross baghouse and the cutsaw baghouse is based on source testing while the quantity emitted from the incinerator baghouse is based on a calculated used in the ESDM report.

Dross is shipped off site for disposal. The quantity of copper is calculated based on the average composition of dross.

Aluminum dust recovered from the incinerator baghouse is sent offsite for recovery. The quantity of copper is calculated based on average composition.

It is considered that the inputs and outputs are approximately equal.

3.0 Estimated Direct and Indirect Costs

Copper is found in the alloy used. As the chromium used is essential to the finished product, there are no options to reduce the usage. Hence the current cost of using copper is not used in any economic feasibility and analysis and at this time has not been quantified. If a technically feasible option is found, the cost of using copper will be developed for use in the economic analysis.

4.0 Identification of Options for Reduction in Usage of Copper

The following options were identified to reduce the usage of copper.

Category	Description
Material substitution/Process modification	Option 1: Use metal alloys that are copper-free. This option would result in the reduction in use of copper or %, reduction of or % contained in product and reduction in kg or % sent offsite for recycling. As the facility is a recycling plant, it does not have control over the content of raw materials. Option 2: Use metal alloys with lower copper content. Reductions will be dependent upon the reduction achieved. As the facility is a recycling plant, it does not have control over the content of raw materials.
Product Design	The product specifications are provided by the customer and SAPA has no control over the process. Furthermore, SAPA is an aluminum processing facility and does not have the ability to substitute different materials in the final product. Hence there is no option available in this category.
Spill and leak prevention	The toxic substance is a solid contained in a metal alloy and hence there is no potential for a spill or leak. All waste material is recycled on-site.
Reuse or recycling	All metal waste is currently collected and recycled on-site and hence there is no additional option available in this category.
Inventory management	The facility is a recycling plant and hence inventory management is not applicable. All waste material is recycled.
Training	The usage of copper in the facility is independent of operator control. Hence there are no options available in this category.

5.0 Analysis 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

The results are recorded in the following table:

Option	Technical Feasibility	Feasible
Option 1: Use metal alloys that are copper-free.	Alloys used as raw materials are scrap that is being recycled on-site. The facility does not have control over the composition of the scrap received.	No
Option 2: Use metal alloys with lower copper content	Alloys used as raw materials are scrap that is being recycled on-site. The facility does not have control over the composition of the scrap received.	No

6.0 Economic Feasibility

As there are no technically feasible options, no economic feasibility is necessary.

7.0 Implementation of Options

Due to customer requirements, there are no technically feasible options available to reduce the use of copper. Hence there are no objectives to reduce the usage of copper.

8.0 Planner Recommendations

As the planner has worked with the facility throughout the development of the plan, any suggestions to improve the plan have been incorporated into the document. There is however one further recommendation:

- If a technically feasible option is identified, develop a total cost of using copper for use in the economic feasibility analysis.

9.0 Certification

As of December 12, 2013, I, Yong Lee, certify that I have read the toxic substance reduction plan for copper 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 with the exception of the regulatory deadline.

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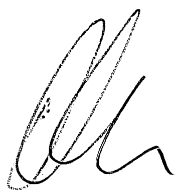

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