WALINGA INC – EAP

July 8, 2021

Director
Environmental Approvals Branch
Manitoba Sustainable Development
Box 80, Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

Re: Notice of Alteration Environmental Act Licence No. 3197

In reference to the Environmental Act Licence No. 3197 issued to Walinga Inc. on August 24, 2016, we are requesting the approval for the addition of a Chrome Plating Line inside our current Hard Coating facility.

In December of 2018 we decommissioned the hard chrome plating line we had been using and installed a new CORVOR hard coating process. This process has been running well for us since then but unfortunately is not able to get us all the desired outcomes for our products, specifically the wear life. Due to this we have worked with Ramboll in designing a Chrome Plating Line that meets the Environmental requirements of our Licence. We plan on continuing to operate the CORVOR hard coating line but at a reduced capacity and having the hard chrome plating line take over as our primary plating process. Upon approval we hope to start the installation of this line in the summer of 2021.

As part of this package we have included the Air Dispersion Modeling report and Design Specifications as developed by Ramboll.

If there is anything missing or you would like more details, please contact either of us via the e-mail or phone numbers below.

Sincerely,

[redacted]

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Notice of Alteration Form

Manitoba
Sustainable Development

Client File No. : 5841.00	Environment Act Licence No. : 3197

Legal name of the Licencee: Walinga Inc.

Name of the development: Chrome Plating Line

Category and Type of development per Classes of Development Regulation:

Manufacturing — Manufacturing and industrial plants

Licencee Contact Person: Ray Beukema
Mailing address of the Licencee: Box 1790
City: Carman Province: MB Postal Code: R0G 0J0
Phone Number: (204) 745-2951 Fax: (204) 745-6309 Email: [redacted]

Name of proponent contact person for purposes of the environmental assessment (e.g. consultant):
Colin Termeer

Phone: [redacted] Fax: [redacted]	Mailing address: Box 1790 Carman MB, R0G0J0

Email address: colin.[redacted]

Short Description of Alteration *(max 90 characters)*:
Addition of a Chrome Plating Line to our current Hard Coating facility.

Alteration fee attached: Yes: ☑ No: ☐

If No, please explain:

Date: July 8, 2021	Signature: [redacted] Printed name: Colin Termeer

A complete Notice of Alteration **(NoA)** consists of the following components:

- ☑ **Cover letter**
- ☑ **Notice of Alteration Form**
- ☑ **2 hard copies and 1 electronic copy of the NoA detailed report** (see "Information Bulletin - Alteration to Developments with Environment Act Licences")
- ☑ **$500 Application fee, if applicable** (Cheque, payable to the Minister of Finance)

Submit the complete NoA to:

Director
Environmental Approvals Branch
Manitoba Sustainable Development
1007 Century Street
Winnipeg, Manitoba R3H 0W4

For more information:

Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/sd/eal

Note: Per Section 14(3) of the Environment Act, Major Notices of Alteration must be filed through submission of an Environment Act Proposal Form (see "Information Bulletin – Environment Act Proposal Report Guidelines")

March 2018

Intended for
Walinga Inc.

Plant Location
Box 1790, 70 3rd Ave NE
Carman, Manitoba
R0G 0J0

Date
June 2021

WALINGA INC.
CARMAN CHROME PLATING LINE DESIGN SPECIFICATIONS

Bright ideas. Sustainable change.

WALINGA INC.
CARMEN CHROME PLATING LINE DESIGN SPECIFICATIONS

Project name	**Walinga – Chrome Plating Line Design – Carmen, MB**
Project no.	**324000625**
Recipient	**Walinga Inc.**
Revision	**0**
Date	**June 16, 2021**
Prepared by	**Phillip Labarge, Taylor Roumeliotis**
Checked by	**Taylor Roumeliotis, William Allan**
Approved by	**William Allan**
Description	**Basic Engineering Design Package for New Chrome Plating Line and Associated Ventilation and Air Pollution Control**

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1. INTRODUCTION AND BACKGROUND

Walinga Inc. (Walinga) is a leading Canadian manufacturer of customized truck bodies and trailers, built primarily for the agricultural industry.

Walinga operates a custom truck body and a pneumatic conveying system manufacturing facility at 70 3rd Ave NE in Carman, Manitoba (Carmen Facility).

In the hard coating line area (HCLA) shop of the west building at the Carmen Facility, Walinga plans to install and commission a new hard chrome plating line in Summer 2021 ("chrome plating line"). This document presents the design basis and equipment specifications for the plating tanks and associated ventilation system.

1.1 Process Description

The new chrome plating line will consist of four (4) new tanks including: one (1) chromic acid plating tank (chrome tank) and three (3) water rinse tanks (rinse tanks 1 to 3). There will be a countercurrent rinse water flow from rinse tank 3, flowing through the other rinse tanks to the chrome tank.

The chrome tank will be equipped with submersible heating coils (four (4) x 30 kW Titanium heating elements), submersible cooling coils (two (2) x Titanium coils with 28 ft^2 surface area each), busbars from a rectifier, and conforming anodes. The rinse tanks will not have any ancillary equipment.

Due to the presence of hazardous chemicals in the chrome tank, a "push-pull" ventilation system and air pollution control (APC) system will be installed on the tank to capture chemical fumes and mist and remove them from the exhaust air stream prior to release to atmosphere.

Parts will be immersed in the tanks using an existing overhead crane and custom racking system, starting at the chrome tank and working sequentially through the tanks, ending at rinse tank 3. An operator will help manually guide the crane and part(s) into and out of the tanks. The part(s) will remain suspended in the chrome solution or water rinse for a predetermined amount of time.

Table 1-1 summarizes the tank sizes, associated equipment, and operating details. Additional details on the tanks and other equipment is provided in subsequent chapters.

Table 1-1: Summary of Tanks and Equipment for the Chrome Plating Line.

Tank Name (ID)	Description	Outer Tank Dimensions (W x L x H)	Operating Temp (°C)	Ancillary Equipment
Chrome Tank (CR-1)	Chromic acid tank	60″ x 48″ x 63″	55 to 75 °C	• Cooling coils • Heating coils • Busbars • Conforming anodes • Fume extraction • Mixer
Rinse Tank 1 (CR-2)	Cold water rinse / Chrome tank top-up	39″ x 48″ x 63″	Room	None
Rinse Tank 2 (CR-3)	Cold water rinse	39″ x 48″ x 63″	Room	None
Rinse Tank 3 (CR-4)	Final water rinse	39″ x 48″ x 63″	Room	None

1.2 Intent of Design

The intent of this design is to specify details for the tanks, secondary containment, fume extraction system, APC system, and controls. The proposed design is described in the following sections, with supporting design and equipment information in the following attachments:

- Attachment A: Fan and Tank Specifications
- Attachment B: Equipment Data Sheets
- Attachment C: Drawings Package

The design does not include the plating chemistries or ancillary plating equipment (e.g. heating coil sizing, rectifier specifications).

1.2.1 Proposed Line Components by JBC Surface Finishing Systems

Walinga has previously received a quotation for the line components and equipment from JBC Surface Finishing Systems ("JBC"), who specialize in the surface finishing lines. Where possible, Ramboll has incorporated JBC's quoted components into this design package.

2. ENGINEERING DESIGN BASIS

2.1 Codes

The tanks and ventilation system were designed according to applicable codes, standards, Manitoba regulations (M.R.), and guidelines including but not limited to:

- Manitoba Building Code (M.R. 31/2011) for "Group F, Division 2 – Medium Hazard Industrial Occupancy".
- Manitoba Electrical Code (M.R. 124/2015) for "Category 1 "Wet" environment classification", at a minimum.
- M.R. 188/2001 "Storage and Handling of Petroleum Products and Allied Products Regulation"

- Canadian Council of Ministers of the Environment (CCME, 2003). "Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products". PN1326. Winnipeg, MB.
- American Conference of Governmental Industrial Hygienists (ACGIH, 2019). "Industrial Ventilation: A Manual of Recommended Practice for Design". 30th Ed. Cincinnati, OH.
- Sheet Metal and Air Conditioning Contractors' National Association (SMACNA, 2006). "HVAC Duct Construction Standards". 3rd Ed.

In addition, the fabrication, construction, and installation of the system shall also comply with these codes, standards, and guidelines:
- CSA International (2000). "Natural Gas and Propane Installation Code Handbook". B149.1. Toronto, ON.

2.2 Plating Line Tanks

The four (4) plating line tanks shall be new, unused and in compliance with the requirements of this design specifications document.

The largest parts to be coated have a maximum width of 39″ (99 cm) or depth of 22″ (56 cm); although not the same part. The parts must remain suspended in the solution and not contact the tank walls or equipment (e.g. submerged coils). Further, the liquid level should be 6″ to 8″ (~15 to 20 cm) below the top of the tank with parts submersed, however it should also not significantly exceed 8″ (20 cm) with part removed (ACGIH, Section 13.70.1 "Tank Design Considerations", and Figure VS-70-10).

A chemical resistant tank or tank liner is required for the chrome tank with chromic acid at elevated temperatures. Polyvinylidene fluoride (PVDF) provides excellent resistance to concentrated chromic acid at the temperatures in this process (e.g. 55°C). Walinga states that the concentration of chromic acid in the first rinse tank is expected to be less than 10% of the original concentration in the chrome tank. If this tank is maintained at room temperature, a PVC liner should provide sufficient resistance. However, if the tank is expected to operate at a temperature above 22°C, a PVDF liner is preferred.

Chromic acid has a severe effect on polypropylene and is, therefore, generally not recommended. However, the final rinse tank should be pure water with a very low concentration of chromic and sulphuric acid and can be used if desired. The polypropylene copolymer proposed by JBC may provide additional resistance to standard polypropylene. Due to the potential effects of trace chromic acid on a polypropylene tank, rinse tank 3 should be periodically inspected to ensure it does not see significant degradation over time or an alternative liner material should be selected.

In consultation with Walinga, Table 2-1 presents the plating line tank dimensions and materials of construction.

Table 2-1: Tank Details

Tank Name (ID)	Outer Tank Dimensions (W x L x H)	Material of Construction	Structural Support
Chrome Tank (CR-1)	60″ x 48″ x 63″	3/16" Carbon Steel Tank, Powder Coat Finish with PVDF Liner	Support braces, as required
Rinse Tank 1 (CR-2)	39″ x 48″ x 63″	3/16″ Carbon Steel Tank, Powder Coat Finish with PVC liner (PVDF liner preferred if temperature >22°C)	Support braces, as required
Rinse Tank 2 (CR-3)	39″ x 48″ x 63″	3/16″ Carbon Steel Tank, Powder Coat Finish with PVC liner	Support braces, as required
Rinse Tank 3 (CR-4)	39″ x 48″ x 63″	PVC Tank or Liner preferred, Copoly Polypropylene may be acceptable alternative	Support braces, as required

The rinse tanks should be equipped with a pipe drain with shut-off valve and threaded nipple along the back width (39″ dimension) to allow Walinga to empty the solution from the tank for maintenance. Walinga has stated that they will drain the chrome tank using a vacuum system, so no drain is required.

The tanks will not have covers. Although Walinga may wish to add tank covers at a later date to contain fumes and retain heat. This design, therefore, includes some provisions and process control to accommodate tank covers.

2.2.1 Chrome Plating Line Arrangement

The chrome plating line will be installed along the southeast corner of the HCLA room. The tanks will be installed as follows (from west to east): rinse tank 3, rinse tank 2, rinse tank 1, and the chrome tank.

The chrome tank shall be installed such that the back of the tank is a minimum of 60″ (152.4 cm) from the wall to allow for maintenance on the APC system (see subsequent sections for details).

The full height of the tank, integrated hood/APC system and the ductwork will be taller than the beams of the crane system. In this arrangement (in the southeast corner), the crane system's runway beam can still be positioned over the tank surfaces to allow the crane to be lowered over the tank. The chrome tank must not be installed more than 12″ (30.5 cm) to the east of the column of the crane system in order to allow the crane to be lowered above the center of the tank surface.

The rinse tanks should be installed in-line with the chrome tank to allow the operator to easily move the crane from one tank to the next while minimizing drips, spray, and splashed liquid onto the floor.

Additional details on tank arrangement are included in the drawings package, Appendix 3.

2.2.2 CorVor Coating Line Arrangement

The CorVor coating line will need to be rearranged to accommodate the new chrome plating line. The tanks will be placed according to the new arrangement provided by Walinga and shown in the drawings package, Appendix 3. A water rinse tank will be retrofitted with a divider wall in the middle to create two smaller rinse tanks at Walinga's request.

The ductwork, bussbars, catwalk and other ancillary equipment serving the CorVor line will need to be moved as well. Details on the duct rerouting are shown in the drawings package, Appendix 3.

2.3 Secondary Containment

There are no incompatible chemicals in the chrome plating line and thus, a single containment berm can be installed around all four tanks.

The berm was sized in accordance with M.R. 188/2001 and CCME (2003) recommendations. Specifically, the berm will be a 7" (~18 cm) tall concrete barrier with sufficient thickness to maintain structural integrity. Additional details on the location and dimensions of the berm are included in the drawings package, Appendix 3.

The floor and berm wall will be coated with a chromic acid resistant epoxy resin suitable for secondary containment (i.e., impermeable for at least 72 hours).

2.4 Fume Suppression and Capture System

The chromium deposition reaction in the chrome tank (CR-1) causes the formation of hydrogen gas on the cathode. When the hydrogen gas evolves, it causes misting at the surface of the bath, which results in chromic acid mist emissions.

A liquid surfactant fume suppressant is recommended to reduce misting at the surface of the bath. However, the fume suppressant will not eliminate the chromic acid mist and therefore, a local exhaust ventilation system is required to capture fume from the chrome tank (CR-1).

The chrome tank is 48" wide and at this width, a push-pull ventilation system is recommended, as per ACGIH. A push-pull ventilation system consists of a blower and perforated pipe at one side of the tank to blow a jet of air across the surface of the tank (i.e. "push manifold") and a lateral exhaust hood at the opposite side of the tank to capture the jet of air and mist (i.e. "pull hood").

2.4.1 Push Manifold

The push manifold is to extend the entire length of the tank, with a series of perforated holes sized 1/8" to 1/4" on 2" centers ("nozzles") in accordance with the ACGIH's Industrial Ventilation Design Manual ("ACGIH"). The outer nozzles are to be located approximately one inch from the inner edges of the tank and the bottom edge of the manifold pipe should be in contact with the top of the tank (no space between push manifold and tank).

Based on the selection of nozzle sizing, the appropriate flow rate and push manifold dimensions should be determined in accordance with the ACGIH calculation procedure. Based on the full range of design permutations possible, this flow rate can range from 35 to 50 actual cubic feet per minute (acfm). For example, given the current dimensions proposed for CR-1 in Table 2-1 and selecting a nozzle size of ¼" with 2" spacing, the required flow rate of the blower would ~50 acfm and the push manifold would require an inner diameter greater than or equal to 2.125". The flow rate shall be controllable by means of manual balancing damper(s) such that the flow rate can be adjusted ±20%.

The push manifold cross sectional area must be greater than or equal to 2.5 times the total nozzle flow area. The push manifold must also be installed with a rotating tube fitting, such as a rotary union, to allow the nozzle angle to be adjusted so that they are pointed 0° (horizontal) down to 20° down from horizontal.

Ramboll also recommends installing a protective cover plate above the perforated pipe to prevent obstructions from being placed too close to the jet and causing air and mist to blow directly into the operator's breathing zone. Prior to starting operation of the plating process, Ramboll recommends conducting pilot tests on the tank and ventilation arrangement to test the efficiency of the push component of the push-pull system. Due to the potential hazard of jet deflection when plating larger parts, additional modifications such as adding a second push manifold above the tank or scheduling the push manifold to turn off while placing or removing the part from the tank may be required.

2.4.2 Pull Hood

The lateral exhaust hood component of the push-pull system shall be designed such that it is a slot type hood installed along the length of the tank and is installed against the edge of the tank so that no gap exists between the slot hood and the tank edge. The slot dimensions should be chosen to achieve a slot velocity of approximately 2000 feet per minute (fpm).

The ACGIH design manual recommends a minimum exhaust flow rate of 100 acfm per ft^2 of tank area (i.e., ~2,000 cfm) for "low activity" processes. For more difficult, high emission processes, such as chrome plating with some obstructions above the surface, higher exhaust flow rates up to over 200 acfm/ft^2 may be required.

Ramboll recommends an exhaust flow rate of 4,000 acfm (i.e. 200 acfm/ft^2) since:

1. ACGIH classifies the chrome plating process as an "A" (highest) hazard with "1" (highest) contaminant evolution due chromic acid's toxicity and the hydrogen gas formation that actively causes chromic acid to be released from the surface.
2. The conforming anodes, electrical cables, and the customized racking system will impede the push jet's path to the lateral hood, so minimum exhaust flow rates (e.g. 100 acfm/ft^2) may be insufficient in practice.
3. A standalone lateral exhaust hood (no push system) on one side of the tank would require approximately 4,800 cfm of flow. A standalone lateral exhaust system would not be affected as significantly by obstructions and therefore represents an upper bound for the design exhaust rate.

4. JBC has also recommended 4,000 cfm (i.e., 200 cfm/ft^2 of open tank area) for the exhaust component of the push-pull system based on industry experience. The packaged APC system JBC has proposed is designed for 4,000 cfm and JBC has indicated that smaller units that can be directly connected to the tank are not available (see subsequent section for details).

Further specifications for the ventilation system are found in Appendix 1 and the drawings package, Appendix 3.

2.4.3 Rinse Tanks

The first and second rinse tanks are expected to have residual chromic acid concentrations in them at less than 10% of the original concentration in the chrome tank in the first rinse tank and at trace amount in the second rinse tanks. However, the rinse tanks operate at room temperature and no hydrogen is expected to evolve (i.e., there is no mechanism to generate chromic acid mist). Further, the HCLA room will exhaust about 14,500 cfm from the existing electroless nickel and new chrome tank ventilation systems, which equates to roughly 23 air changes per hour (ACH). Trace emissions from the rinse tank are not expected to accumulate significantly in the room.

Therefore, no local ventilation hoods are recommended for these tanks.

2.4.4 Air Pollution Control System

Three feasible, commonly used APC technologies for chrome plating tanks are:

i. Composite mesh pad (CMP) systems,
ii. Packed-bed scrubber (PBS) systems, and
iii. Fiber-bed mist eliminators.

High efficiency particulate arrestor (HEPA) filters are common add-on APC devices to CMP systems in the United States, where a hexavalent chromium emission limit of 0.006 milligrams per dry standard cubic meter (mg/dscm) is enforced for new chrome tanks under the National Emission Standards for Hazardous Air Pollutants (NESHAP). These CMP and HEPA filter systems provide the most effective control for chromic acid mist (i.e., at least 99.97% control at 0.3 microns to qualify as HEPA filtration).

This combined CMP and HEPA filter is the preferred APC system for Walinga's chrome plating line, in part because of its high mist removal efficiency compared to other systems, which will allow Walinga to install a shorter stack while still meeting the applicable ambient air quality criteria (AAQC), which is discussed further in the subsequent section. This system also has a relatively small footprint as compared to PBS systems, making it ideal for the smaller HCLA room.

Briefly, CMP systems are multi-stage mesh pads which use progressively tighter media structures to remove progressively finer mists. The final stage is an add-on HEPA filter used as a polishing step to achieve a high level of control. These mechanical systems are relatively easy to operate, maintain, and troubleshoot since there are no moving parts.

The pressure drop across each stage of the CMP and HEPA filter system should be monitored continuously as an indication of on-going performance. Details on the sensors and alarms are provided in the subsequent chapter and the data sheet package, Appendix 2.

An "at-source" CMP and HEPA filter system is preferred over an "end-of-pipe" system for two main reasons:

i. The APC system will remove most mist from the exhaust stream which allows for standard materials of construction (MoC) to be used for the ducting and fan with less chance of significant condensation and gradual corrosion; and
ii. The mist eliminators can be cleaned with water and drained directly into the chrome tank.

Additional details on the APC system are provide in the specification package, Appendix 1.

2.4.5 Ductwork Design

The exhaust flow associated with the local ventilation hood for the chrome tank will be conveyed to an induced draft fan and a dedicated exhaust stack outside of the HCLA, through the east wall. This ductwork will consist of a single trunk with no additional branches ("Line CR"). This trunk shall be installed in accordance with the drawings in Appendix 3.

Line CR shall be constructed of PVC pipe with an inner diameter of approximately 16" (~40.6 cm). This inner diameter has been specified to ensure that the average transport velocity in the trunk is greater than 2,500 fpm. The chromic-sulphuric acid fume may settle at transport velocities below 2,500 fpm and cause deterioration to the ductwork despite the mist being pre-controlled by the APC system described above. Additional details are provided in the specification package, Appendix 1.

2.4.6 Fan Design

A centrifugal fan will be used to induce the flow required for the local ventilation system described above. This fan should be sized for a flow rate of 4,000 cfm at 86 °F (~6,800 m^3/hr at 30 °C) and a static pressure of greater than or equal to 7.5 inches of water column ("H_2O). The estimated static pressure requirement is detailed in Table 2-2 below.

Table 2-2: Details of Pressure Drop Model Across Exhaust System

Loss Component	Pressure Drop ("H2O)	Notes/Assumptions
Acceleration	0.51	
Slot	0.51	
APC	3.5	based on JBC provided materials for ScrubAir unit
Duct Entry	0.26	
Ductwork Minor/Major and Elevation Changes	0.96	
System Effect	0.34	90° bend with turn radius of 1 r/D 2D before fan inlet (~32")
Room Negative Pressure	1	assumed
Total	7.5	rounded to the next highest ½"H2O to allow for system balancing

Walinga is considering installing a tank cover in the future to limit heat loss when not in use (not part of this design). When the cover is over the tank surface, less air flow is required so the fan should have a variable frequency drive (VFD) to allow for flow control. It will also allow for field adjustments during commissioning.

Walinga has requested that the fan be installed on the roof of a to-be constructed extension to the chiller/rectifier shed adjacent to the HLCA building to the east, south of the existing CorVor rectifier shed (by others). See the drawings package in Appendix 3 for more details.

2.4.7 Stack Design

A new exhaust stack is required to exhaust and adequately disperse the emissions of hexavalent chromium contained in the exhaust stream of Line CR. This stack is to be located in the courtyard just east of the HCLA building and new chiller/rectifier shed. The stack shall be designed to have a diameter of 16" (40.6 cm) with a zero-loss discharge head to prevent rain from entering the stack when not in use or operated at a reduced flow rates. The total stack height, including the zero-loss discharge head is 45 feet above grade (~13.7 meters). This stack design will adequately disperse residual hexavalent chromium emissions from the APC system to meet the applicable AAQC. Additional details on the air dispersion modelling are provided in a separate letter from Ramboll (Ramboll P/N 324000625, June 2021).

The stack shall be constructed of PVC or a material that can provide equivalent resistance to chromic and sulphuric acid. Further details on the location and construction of the exhaust stack can be found in Appendices 1 and 3.

2.5 Other Design Considerations

2.5.1 Materials of Construction

The primary drivers for material of construction constraints are chromic acid (<30%vol) and sulphuric acid (<10%vol) used in the chrome tank of the proposed chrome plating process. Table 2-3 below details typical resistances of common materials to these compounds.

Table 2-3: Material Resistance Summary

Chemical	Carbon Steel	Stainless Steel (304/316)	PVC	PVDF	PP
Chromic Acid (CrO_3, $Cr_2O_7^{2-}$) (<30%vol)	D - Severe effect (Not recommended) D - Poor	B - Minor effect (Good) B - Good (up to 48°C)	A - No effect (Excellent) A - Excellent (up to 22°C) 2 - Limited Resistance (60°C) 1 - High Resistance (20°C)	A - Excellent (up to 48°C) 2 - Limited Resistance (100°C) 1 - High Resistance (60°C)	A - No effect (Excellent) D - Poor 3 - No Resistance (60°C) 2 - Limited Resistance (20°C)
Sulphuric Acid (H_2SO_4) (<10%vol)	D - Poor	D - Severe effect (Nor recommended) B - Good (up to 48°C)	A - No effect (Excellent) A - Excellent (up to 22°C) 1 - High Resistance (60°C)	A - Excellent (up to 48°C) 1 - High Resistance (60°C)	A - No effect (Excellent) A - Excellent (up to 48°C)
Sources					
a. AAP Industries. Section 15, Technical Data/Chemical Resistance Chart, Edition 2. Available from: https://www.aapindustries.com.au/AAP-Catalogue-Sections/AAP-S15-Technical-Data-S.pdf					
b. Cole-Parmer, 2019. Chemical Compatibility Database Available from: https://www.coleparmer.ca/chemical-resistance					
c. IPEX Inc. Chemical Resistance Guide, Thermoplastic Piping Systems.					

This report specifies materials of construction for most of the components involved; however, for those components that have not had a material of construction specified, that are expected to come into contact with the contents of the chromic-sulphuric acid plating bath or its fume, should be constructed of a material that is resistant to the compounds discussed above. For proprietary materials and those not considered in the table above, the vendor shall ensure that the resistively of the material is adequate to ensure continued performance and operation.

2.5.2 Chiller/Rectifier Shed

A rectifier shed extension is required to house the new chiller and rectifier used to operate the cooling coils and busbars used in the proposed chrome tank. This extension will be located adjacent to the HLCA building to the east, south of the existing CorVor rectifier shed. See the drawings package in Appendix 3 for more details. The shed must be designed to house the chiller and rectifier used as part of the proposed chrome plating process, and all associated ancillary equipment. The shed must also be of sufficient structural integrity and include a fan support frame to support and accommodate vibration inputs from the previously mentioned fan on its roof. Further details can be found in the specification package in Appendix 1. Structural design of this shed and fan support frame are to be provided by others.

2.5.3 Hydrogen Gas and Enclosures

The plating process occurring in the chrome plating tank generates hydrogen as an off gas. This hydrogen gas can be an explosive hazard when contained in an enclosed space. Due to the potential hazard, proper control procedures and standard operating instructions should be prepared if Walinga plans to enclose the chrome plating tank when it is not in operation. For example, preventing the chrome bath equipment from starting up when the tank is enclosed, or running the ventilation system for a nominal period of time after the electroplating reaction has stopped and all parts removed before enclosing tank.

2.5.4 Chromic Acid Make-up

Chromic acid in the chrome plating tank is regenerated by the addition of solid chromium trioxide, a hexavalent chromium compound. Exposure to dust generated from the addition of this compound to the plating bath by a worker could represent a significant health risk if not done properly. It is recommended that a standard operating procedure be developed for this process to minimize potential risk to workers.

2.5.5 Crane Modification

Ramboll recommends some minor modifications to Walinga's existing crane system to accommodate the APC device and proposed tank height of 63 inches included in the JBC proposal. With the proposed dimensions and configuration, the outlet duct from the proposed APC will not be able to remain under the height of the crane system's cross beams and therefore will need to be ducted over this beam towards the east wall of the HCLA. To prevent the mobile beam of the crane system from unintentionally impacting the proposed APC device, Ramboll suggests that blocks or other stopping mechanisms be added to the crane's cross rails.

3. CONTROL NARRATIVE

3.1 Process Elements

The process control system consists of the following elements:

Chrome Plating Tank

- Chrome Plating Tank with Cover, CR-1 (cover optional)
- Heating/Cooling Subsystem
  - Temperature Controller, PLC-2
  - Heating Coils, HC-CR1
  - Cooling Coils, CC-CR1
  - Solenoid Valve, S-CR1
- Electrical Current Subsystem
  - Rectifier Controller, PE280
  - Rectifier, RC-CR1
  - Rectifier Chiller, RCC-CR1
  - Busbars, BB-CR1
- Mixer, MX-CR1
- Potentiostat, EIC-CR1
  - Conforming anodes, AN-CR1
- Limit Switch, ZS-CR1 (optional)

Ventilation System

- Line CR Fan, FAN-CR1
- Line CR Fan VFD, VFD-CR1
- Push System Blower, BL-CR1
- Programmable Logic Controller, PLC-CR1

CMP System

- Pressure Transmitter, PT-CR1
  - First pressure transmitter, before CMP system
- Pressure Transmitter, PT-CR2
  - Final pressure transmitter, after CMP system

Refer to the P&ID, Drawing P-02, Attachment 3 for additional details.

3.2 Sensors and Signals

1. Line CR's fan VFD, VFD-CR1, shall input frequency to PLC-CR1 and PLC-CR1 shall display frequency setpoint. The normal operating setpoint shall be established during commissioning.
2. Pressure transmitters PT-CR1 and PT-CR2 signals shall be input to PLC-CR1 and readings displayed on the screen of PLC-CR1. The normal operating range shall be established during commissioning.
3. A current transmitter controller (ITC) from blower, BL-CR1, shall input to PLC-CR1 and PLC-CR1 shall display power signal.

4. A current transmitter controller (ITC) from mixer, MX-CR1, shall input to PLC-CR1 and PLC-CR1 shall display power signal.

3.3 Control Systems

3.3.1 Ventilation Flow Control

1. The amount of ventilation flow to Line CR shall be controlled by VFD-CR1, with a manually adjusted frequency setpoint.
2. The frequency setpoint for VFD-CR1 required to operate FAN-CR at the desired ventilation flow rate during regular operation shall be determined during commissioning.
3. The flow provided to the push manifold by BL-CR1 shall be controlled by means of manual control valve. The setting to achieve the desired push manifold flow rate shall be determined during commissioning.
4. BL-CR1 shall be equipped with a manual start-stop button near CR-1, with visual alarm to indicate interrupted operation. This button may be used by the operator to halt the blow function while adding and removing parts from CR-1, dependent on the findings of pilot testing.

Tank CR-1 may optionally be equipped with a tank cover and limit switch, ZS-CR1. If Walinga considers a tank cover in the future for tank CR-1, Walinga will need to adequately address the hazard potentials of hydrogen gas build-up in the tank as well as redirecting the push ventilation jet at the operator through engineering design. For completeness, some control logic on a tank cover is discussed below.

1. Tank CR-1 will be equipped with a limit switch, ZS-CR1 if a tank cover is used.
2. ZS-CR1 will determine if the tank cover is closed.
3. If a signal from ZS-CR1 is lost, an alarm will sound.
4. If the ZS-CR1 switch signal is not triggered, the system will assume the tank is fully open (i.e., CR-1 is "not closed").
5. If the cover for CR-1 is in the closed position, VFD-CR1 shall be set to a second setpoint ("low flow condition") which will nominally be 20% of the design flow rate[1] and power to BL-CR-1 shall be disabled.
6. If the cover is in the not closed position, VFD-CR1 and BL-CR1 should operate as normal (i.e., 100% of design setpoint for VFD-CR1 and power to BL-CR1 shall be enabled).

3.3.2 Mixer Control

1. If VFD-CR1 is off (no signal, power to fan lost), ZS-CR-1 is in the closed position, or the second-level dP Alarm signal is active, the power to MX-CR1 shall be disabled.
2. Otherwise, MX-CR1 shall operate as required by the process as described in the start-up and shut-down procedures and be controlled by PLC-CR1.

[1] Actual value may be adjusted based on data from commissioning and operation.

3.3.3 Tank Heating/Cooling Control

1. The heating and cooling coils provided with CR-1, HC-CR1 and CC-CR1 shall be controlled by a controller provided by the vendor, PLC-2.
2. PLC-2 shall operate HC-CR1 ad CC-CR1 to achieve a setpoint for the operating temperature of CR-1 when the chrome plating process is in operation.
3. If VFD-CR1 is off (no signal, power to fan lost), ZS-CR-1 is in the closed position, or the second-level dP Alarm signal is active, the power to HC-CR1 shall be disabled.
    a. (optional) If the condition above is true, PLC-2 may be set to a setpoint at approximately room temperature and CC-CR1 may be used to cool the tank to this setpoint.

3.3.4 Rectifier Control

General rectifier (RC-CR1) and rectifier chiller (RCC-CR1) operation to be specified by equipment vendor and be controlled by a controller provided by the vendor, PE280. However, vendor should allow for the following control logic to be integrated into its operation.

1. If VFD-CR1 is off (no signal, power to fan lost), ZS-CR-1 is in the closed position, or the second-level dP Alarm signal is active, the power to RC-CR1 and/or BB-CR1 shall be disabled to prevent electrical current from being supplied to CR-1.

3.4 PLC Alarms

5. If the difference between the pressure readings transmitted from PT-CR1 and PT-CR2 is 0.75 "H2O greater than or less than the differential pressure established as the normal operating point during commissioning, an alarm will sound (LOW / HIGH dP Alarm) and PLC-CR1 shall output a signal indicating the first-level dP Alarm is in effect ("active"). It is recommended that Walinga cease plating operations after the current part being plated is completed and investigate the cause in the event of a first-level dP Alarm, if feasible to do so.
6. If the difference between the pressure readings transmitted from PT-CR1 and PT-CR2 is 1.0 "H2O greater than or less than the differential pressure established as the normal operating point during commissioning, or a signal from either sensor is lost, an alarm will sound (LOW LOW / HIGH HIGH dP Alarm) and PLC-CR1 shall output a signal indicating the second-level dP Alarm is in effect ("active"). This should initiate an emergency shutdown condition.
7. If the signal from VFD-CR1 or the power to VFD-CR1 is lost while the system is not in the shutdown mode, an alarm will sound.
8. If the power to BL-CR1 is lost while the system is not in the shutdown mode, an alarm will sound.
9. The control system shall include a means to acknowledge and silence each of the above alarms.

Only those sensors and alarms required to ensure the safe operation of the chrome plating tank, CR-1, and its ventilation system have been described in this section. Other sensors and alarms may be included by vendors for additional information or equipment performance (e.g., intermediate pressure transmitters between each CMP within the APC system).

3.5 Operating Scenarios

3.5.1 Start-up (with Tank Covers Installed)

1. If starting up from a shut down, power to VFD-CR1 to be enabled.
2. Tank CR-1 cover to be removed manually.
3. Power to BL-CR1 to be enabled.
4. Power to MX-CR1 to be enabled.
5. Heating/Cooling Subsystem to be enabled and begin operating to approach plating process setpoint temperature, controlled by PLC-2.
6. Once tank approaches temperature setpoint, Electrical Current Subsystem to be enabled and controlled by PE280.
7. Plating operations to be initiated.

3.5.2 Shutdown/Standby (with Tank Covers Installed)

1. Plating operations to be ceased and all parts to be removed from tank CR-1, following standard operating procedures.
2. Electrical Current and Heating/Cooling Subsystems and MX-CR1 to be disabled.
3. After nominal period of time, BL-CR1 to be disabled.
4. For standby operation, tank cover to be manually closed by operators, initiating VFD-CR1 to operate at its low flow condition per the flow control logic described above.
5. For a shutdown, tank cover to be manually closed by operators and then power to VFD-CR1 to be disabled after pre-determined period of time (nominally 15 minutes) at low flow condition.

3.5.3 Emergency Stop

1. In addition to the emergency stop conditions outlined in the control logic, emergency stop buttons should exist near CR-1 and in the control room near PLC-CR1.
2. If either of the emergency stop buttons described above are activated, this shall disable power to the Electrical Current and Heating/Cooling Subsystems and MX-CR1 to mitigate the generation of chromic acid fume. An alarm shall sound. VFD-CR1 and BL-CR1 are to remain in operation at full flow condition.
3. Whether activated by control logic and sensors or by manual activation by the emergency stop buttons described above, operators should vacate the plating area and not remove any parts that are currently in the plating bath. Removing parts from the plating bath could lead to additional emissions and exposure.

APPENDIX 1: SPECIFICATIONS

OWNER	WALINGA
PROJECT TITLE	CHROME PLATING LINE DESIGN
SITE	CARMAN, MB
DEPARTMENT	HARD COATING LINE AREA
SPECIFICATION	SP-01

SPECIFICATION Number: SP-01			
June 16, 2021	ISSUED FOR TENDER	PL	0
DATE	**ISSUED FOR**	**BY**	**REV. NO.**

RAMBOLL

CONTENTS

END OF SECTION

1 INTENT

1.1 It is the intent of this specification to provide the performance requirements for the supply and installation of:

1.1.1 One (1) new composite mesh pad system, performing as an air pollution control system serving the exhaust collected from the chrome plating tank as part of a proposed hard chrome plating process in the HARD COATING LINE AREA,

1.1.2 One (1) new fan and stack line serving the ventilation system for the proposed hard chrome plating process in the HARD COATING LINE AREA, and

1.1.3 Four (4) new process tanks used as part of the proposed hard chrome plating process in the HARD COATING LINE AREA.

1.2 These systems form part of a proposed hard chrome plating process and its associated ventilation system at the WALINGA facility in CARMAN, MB. All systems shall be delivered FOB, to this facility.

1.3 This Specification should be read in conjunction with the Engineering Design Documents associated with this project.

END OF SECTION

2 SCOPE OF SUPPLY

2.1 The project is located at the WALINGA facility in Carman, MB.

2.2 The equipment defined by this Specification will be located at and will serve the proposed chrome plating line in the HARD COATING LINE AREA located at the facility. The operations and production lines served by these ventilation systems are listed below.

Production Line / Operations	Equipment ID	Technology	Scope of Supply
• Hard Chrome Plating Line, Chrome Tank	CR-1	Ventilated Tank	New
• Hard Chrome Plating Line, Rinse Tank 1 to 3	CR-2, CR-3 and CR-4	Tanks	New
• Hard Chrome Plating Line, Composite Mesh Pad System	CMP-1	Air Pollution Control Device	New
• Hard Chrome Plating Line, Exhaust Fan for CR-1	FAN-CR, STACK-CR	Fan and Stack	New

2.3 The drawings, specifications and equipment descriptions referenced herein do not attempt to describe every subject and detail of the Supply. Further, it is the intent of this Scope of Supply that all work be performed in a safe and workmanlike manner. Any omission of such instructions or of any work obviously intended or necessary to secure a safe, complete, workmanlike job shall not excuse the Seller from doing such work as may be necessary to produce such a job.

2.4 The Seller is responsible for layout and verification of all measurements and elevations. The Seller shall notify the Owner's Project Manager if any discrepancies are found before the manufacture or procurement of any affected equipment.

2.5 All materials of manufacture shall be new, unused and in compliance with the requirements of this Specification and related documents.

2.6 All electrical components to comply with Manitoba Building Code Group F, Division 2 – Medium Hazard Industrial Occupancy, based on low fire load.

END OF SECTION

3 TANKS

3.1 CR-1: Chrome Tank

3.1.1 General Service and Requirements:

Parameter	**Units**	**CR-1**
Outer Dimensions	in (cm)	60” (152 cm) x 48” (121 cm) x 63” (160 cm) [LxWxH]
Secondary Containment		Constructed Spill Berm (see Drawing M-01)
Material of Construction		3/16" carbon steel tank, powder coat finish with PVDF liner
Temperature (operating)	°F (°C)	130 to 165 °F (55 to 75°C)
Cover Type		None
Hood Type		Push-Pull Push, per ACGIH Figure VS-70-01, Table 13-72-1 Pull, per ACIGH Figure VS-70-01, Type A
Heating/Cooling		Heating coils per vendor specification Cooling coils per vender specification
Anodes		Conforming Type, design by others
Drain		None
Mixer		Per vendor specification

3.1.2 Construction and Installation Details

a) Support braces as required

b) All pieces of equipment (heating/cooling coils, mixer, conforming anodes, busbars, etc.) shall be installed such that they do not impede either the pull system or push system associated with the ventilation system designed for this tank.

c) A protective horizontal cover plate over ventilation push manifold with cut-out for angle adjustment as required

3.2 CR-2, CR-3 and CR-4: Rinse Tanks 1, 2 and 3

3.2.1 General Service and Requirements:

Parameter	**Units**	**CR-2/CR-3/CR-4**
Outer Dimensions	in (cm)	39” (99 cm) x 48” (121 cm) x 63” (160 cm) [LxWxH]
Secondary Containment		Constructed Spill Berm (see Drawing M-01)
Material of Construction		CR-2/CR-3: 3/16” Carbon Steel, Powder Coat Finish, with PVC liner CR-4: Copoly polypropylene
Temperature (operating)	°F (ºC)	Room temperature
Cover Type		None
Hood Type		None
Heating/Cooling		None
Anodes		None
Drain		Pipe with shut-off valve and threaded nipple

3.2.2 Construction Details

a) Support braces as required

b) 2” diameter drain pipe at the back length of tank

END OF SECTION

4 AIR POLLUTION CONTROL SYSTEM

4.1 Chrome Composite Mesh Pad, CMP-1

4.1.1 General Service and Requirements:

Parameter	Units	CMP-1
Service		Air Pollution Control for fume generated from hard chrome plating tank (Chromic-Sulfuric bath type)
Location		Indoors
Minimum/Maximum Temperature	°C	15 / 75
Gas Volume	Aft^3/min (m^3/hr)	4000 (6800)
Gas Inlet Temperature	°C	30
Outlet Damper		Not required
Maximum Loading at Outlet		
Hexavalent Chromium Compounds – Cr(VI)	mg/dscm	0.006 (maximum)
Vessel Construction		Vendor to specify Resistant to chromic acid and sulfuric acid fume
Dimensions		Length: ≤ 60 inches Width: ≤ 36 inches Height: ≤ 84.5 inches
Duct Connection (outlet)		PVC Duct (~16” ID)
Base		Support frame per vendor specification
Mesh Pad Cleaning		Automatic Washdown Cycled on/off based on timer
Exhaust Fan		See FAN-CR Specification in Section 5.2

4.1.2 Construction and Installation Details

a) Support frame and CMP-1 installed such that:

a. Bottom of CMP-1 is flush with the top of tank CR-1, to allow slot type fume extraction hood construction; and

b. There is ≥ 1 inch of clearance between the top of CMP-1 and an existing crane support beam approximately 148.5 inches above the ground at the installation location.

b) CMP-1 installed such that routine maintenance, including any filter replacement, not restricted by proximity to walls, support columns or process equipment.

c) CMP-1 frame to include access panels and doors to allow access to all components of the unit,

4.1.3 Instrumentation and Controls

a) Pressure transmitters before the first mesh pad stage and after the final HEPA filter stage to monitor overall pressure drop

b) Other instrumentation per vendor specification to ensure proper operation and attainment of vendor specified guaranteed outlet concentration of hexavalent chromium.

c) Instrumentation controls to be installed within existing control room located within 100 feet of CMP-1.

END OF SECTION

5 EXHAUST FANS AND MOTORS

5.1 BL-CR1 – Blower for Push System Serving Chrome Tank

5.1.1 General Service and Requirements:

Parameter	Units	BL-CR1
Service		Pressure blower, for push ventilation system on tank CR-1 (see Specification in Section 3.1)
Location		Indoors
Configuration		Centrifugal SWSI Backward curved or inclined Class III construction Scroll Drain
Dust Loading at Inlet	mg/dscm	Room air
Gas Volume	Aft^3/min	50
Static Pressure	in. H_2O	~9
Temperature (maximum operating)	°F (°C)	105 (40)
Temperature (cold start)	°F (°C)	60 (15)
Moisture Content	% vol.	Room air
Inlet damper		Not Required
Outlet Damper		None
Vibration Isolation (ductwork)		None
Arrangement		10
Rotation		Counter Clockwise (CCW)
Discharge		Top Horizontal (TH)
Bearings		Vendor to specify
Shaft		Vendor to specify

Casing		Welded Standard inspection door Pre-drilled flanged outlet Scroll drain
Base		Steel Frame Vibration isolation
Motor		TEFC 575 V Power TBD by Vendor Speed TBD by Vendor

5.1.2 Instrumentation and Controls

a) Current transmitter, input to/output from PLC

b) Gate valve or similar for flow control

5.2 FAN-CR – Exhaust Fan for Chrome Tank

5.2.1 General Service and Requirements:

Parameter	Units	FAN-CR
Service		Induced draft fan, post CMP-1 (see Specification in Section 4)
Location		Outdoors
Configuration		Centrifugal SWSI Backward curved or inclined Class III construction Scroll Drain
Dust Loading at Inlet	mg/dscm	<0.05 (as fume)
Gas Volume	Aft^3/min	4000
Static Pressure	in. H_2O	7.5
Temperature (maximum operating)	°F (°C)	105 (40)
Temperature (cold start)	°F (°C)	-4 (-20)
Moisture Content	% vol.	Saturated
Inlet damper		Not Required
Outlet Damper		Opposed blade damper, fixed to outlet
Vibration Isolation (ductwork)		Flexible fabric type flex connections at inlet and outlet
Arrangement		10
Rotation		Clockwise (CW)
Discharge		Bottom Angular Upblast (BAU)
Bearings		Corrosion Resistant coating
Shaft		Corrosion Resistant

Casing		Welded Standard inspection door Pre-drilled flanged outlet Scroll drain Corrosion Resistant
Base		Steel Frame Vibration isolation
Motor		TEFC 575 V Power TBD by Vendor Speed TBD by Vendor

5.2.2 Instrumentation and Controls

c) VFD controller, input to/output from PLC

d) Local Control Panel – Features TBD

5.2.3 Stack

a) Free standing with engineered base. Base design and construction to be provided by vendor.

b) Stack exit height above grade 39 ft 8 in. (12.1 m).

c) Diameter 16 inch (40.64 cm)

d) Zero-loss discharge head with 17-inch diameter and 5 ft 10 in. long for total stack height of 45 ft (13.7 m).

e) PVC construction

f) Inlet breeching at 45° up blast angle

g) Drainage: angled plate with 2” (5.1 cm) threaded nipple

h) Sampling ports: 2 x 3” (7.6 cm) diameter, 4” (10.2 cm) long half coupling with male threads /w threaded cap, locate according to drawings, minimum 2 duct diameters below stack exit and minimum 6 duct diameters above fan outlet breaching connection

i) Paint: per WALINGA specification

END OF SECTION

6 SUPPORT SERVICES TO BE PROVIDED

6.1 Installation

6.1.1 All items and components in this specification are to be designed, fabricated, supplied by Seller or qualified affiliate of Seller. Installation may be provided by others. Optional installation pricing shall be provided.

6.1.2 Integration of control signals with plant operating control system and data management system are to be provided by Seller.

6.2 Field Testing and Start-up

6.2.1 Seller shall provide full commissioning and start-up services, support will be provided by Owner

6.2.2 Tuning and adjustment of all components is to be provided by Seller, oversight will be provided by Owner

6.2.3 Testing to demonstrate individual flow and pressure capacity to be provided by Seller, oversight will be provided by Owner

END OF SECTION

7 EXCLUSIONS

7.1 The following are not included in the Scope of Work beyond that which is required by certain Seller packages, but may be required to be provided by Owner or others in order to provide a complete and functional system.

a) Civil work and site preparation

b) Electrical power supply design

END OF SECTION

APPENDIX 2: DATASHEETS

DS-01 BALANCING VALVES

ITEM NO: **As indicated**
OWNER: **Walinga Inc.**
LOCATION: **Carman, Manitoba**
SPEC No.: **DS-01**
PROJECT NO.: **324000625**
PROJECT NAME: **Carman Chrome Plating Design**
DEPARTMENT: **Hard Coating Line Area (HCLA)**

GENERAL

Balancing dampers for control of push system manifold as part of industrial ventilation system capturing plating fumes.

DESIGN

DAMPER TYPE: Gate or Similar
CROSS SECTION: Circular
DIMENSIONS: See schedule
BEARING TYPE: Vendor to specify.
BLADE TYPE: Knife
ACTUATOR TYPE: Manual, Standard
ACTUATOR MODE: Manual
CTRL ACCESSORIES: None.
MIN / MAX TEMP: 15 / 30 deg C
OPERATION: adjustable
ACCESSORIES: Vendor to specify.

TYPICAL PRESSURE: 15 in H2O (gauge)
MAX FLOW: 100
TYPICAL FLOW: 0 to 50 cfm

MATERIALS OF CONSTRUCTION

HOUSE MATERIAL: Vendor to specify
SHAFT MATERIAL: Vendor to specify
BLADE MATERIAL: Vendor to specify
BLADE SEALS:
JAMB SEALS: None
AXLE SEALS: None
LINKAGES:

SPECIFICATION NUMBER: DS-01

2021-06-16	ISSUED FOR TENDER	TR	0
DATE	ISSUED FOR	BY	REV. NO.

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DS-01 BALANCING VALVES

ITEM NO:	**As indicated**	PROJECT NO.:	**324000625**
OWNER:	**Walinga Inc.**	PROJECT NAME:	**Carman Chrome Plating Design**
LOCATION:	**Carman, Manitoba**	DEPARTMENT:	**Hard Coating Line Area (HCLA)**
SPEC No.:	**DS-01**		

SCHEDULE

Drawing Ref No.	Valve ID	Style	Qty	D (in)	L (in)	W (in)				
P-02	CD-CR1		1	2.125						

SPECIFICATION NUMBER: DS-01

2021-06-16	**ISSUED FOR TENDER**	**TR**	**0**
DATE	ISSUED FOR	BY	REV. NO.

RAMBOLL

DS-02 OPPOSED BLADE DAMPERS

ITEM NO:	As indicated	PROJECT NO.:	324000625
OWNER:	Walinga Inc.	PROJECT NAME:	Carman Chrome Plating Design
LOCATION:	Carman, Manitoba	DEPARTMENT:	Hard Coating Line Area (HCLA)
SPEC No.:	DS-02		

GENERAL

Backdraft preventors for Fan (FAN-CR) during maintenance.

DESIGN

DAMPER TYPE:	Opposed Blade Damper
CROSS SECTION:	Rectangular
DIMENSIONS:	See schedule
BEARING TYPE:	
BLADE TYPE:	opposed blade
ACTUATOR TYPE:	manual, standard
ACTUATOR MODE:	manual
CTRL ACCESSORIES:	
OPERATION:	
MIN / MAX TEMP:	-40 / 40 C
TYPICAL TEMP:	ambient outdoor
MIN / MAX PRESSURE:	atmospheric
TYPICAL PRESSURE:	atmospheric
ACCESSORIES:	
SHAFT:	
BLADE SEALS:	
MAX VELOCITY:	3000 ft/min forward
LIMIT SWITCHES:	
BLADE THICKNESS:	As required for pressure
TYPICAL PRESSURE:	7.5 in H2O (gauge)

MATERIALS OF CONSTRUCTION

FRAME MATERIAL:	Steel with Plastic or Corrosion Resistant Coating
SHAFT MATERIAL:	Steel with Plastic or Corrosion Resistant Coating
BLADE MATERIAL:	Steel with Plastic or Corrosion Resistant Coating
BLADE SEALS:	
JAMB SEALS:	None
AXLE SEALS:	None
LINKAGES:	Standard painted coating; standard colour

SPECIFICATION NUMBER: DS-02

DATE	ISSUED FOR	BY	REV. NO.
2021-06-16	ISSUED FOR TENDER	TR	0

DS-02 OPPOSED BLADE DAMPERS

ITEM NO:	As indicated	PROJECT NO.:	324000625
OWNER:	Walinga Inc.	PROJECT NAME:	Carman Chrome Plating Design
LOCATION:	Carman, Manitoba	DEPARTMENT:	Hard Coating Line Area (HCLA)
SPEC No.:	DS-02		

SCHEDULE

Drawing Ref No.	Valve ID	Style	Qty	L (in)	W (in)					
P-02	OBD-CR1		1	16	12					

SPECIFICATION NUMBER: DS-02

2021-06-16	ISSUED FOR TENDER	TR	0
DATE	ISSUED FOR	BY	REV. NO.

DS-03 DUCT DRAINS

ITEM NO:	As indicated	PROJECT NO.:	324000625
OWNER:	Walinga Inc.	PROJECT NAME:	Carman Chrome Plating Design
LOCATION:	Carman, Manitoba	DEPARTMENT:	Hard Coating Line Area (HCLA)
SPEC No.:	DS-03		

GENERAL

Duct drains used to removed condensate from ventilation network.

DESIGN

GENERAL

TYPE:	Gate Valve
TEMPERATURE:	15/30 deg C
LOCATION:	Indoors

MATERIALS OF CONSTRUCTION

Line CR - PVC

SPECIFICATION NUMBER: DS-03

2021-06-16	ISSUED FOR TENDER	TR	0
DATE	ISSUED FOR	BY	REV. NO.

DS-03 DUCT DRAINS

ITEM NO:	As indicated	PROJECT NO.:	324000625
OWNER:	Walinga Inc.	PROJECT NAME:	Carman Chrome Plating Design
LOCATION:	Carman, Manitoba	DEPARTMENT:	Hard Coating Line Area (HCLA)
SPEC No.:	DS-03		

SCHEDULE

Drawing Ref No.	UNIT ID	SPEC. CONDITIONS		D (in)	Qty		
P-02	DR-CR1	Acid Mist Condensation		2	1		

SPECIFICATION NUMBER: DS-03

2021-06-16	ISSUED FOR TENDER	TR	0
DATE	ISSUED FOR	BY	REV. NO.

DS-04 PROCESS CONTROL EQUIPMENT

ITEM NO:	As indicated	PROJECT NO.:	324000625
OWNER:	Walinga Inc.	PROJECT NAME:	Carman Chrome Plating Design
LOCATION:	Carman, Manitoba	DEPARTMENT:	Hard Coating Line Area (HCLA)
SPEC No.:	DS-04		

GENERAL

Process Control Equipment to control tank heaters, APC, and ventilation systems

Equipment to include alarms

DESIGN

MAKE/MODEL	Vendor to specify.
CONTROL LOGIC	See Control Narrative
SENSOR TYPE:	VARIOUS (see schedules)
MIN / MAX TEMP:	15 / 40 deg C
ACCESSORIES:	Vendor to specify

MATERIALS OF CONSTRUCTION

COVER:	Make/Model dependent. Vendor to specify

SPECIFICATION NUMBER: DS-04

2021-06-16	ISSUED FOR TENDER	TR	0
DATE	ISSUED FOR	BY	REV. NO.

DS-04 INSTRUMENTATION

ITEM NO:	**As indicated**	PROJECT NO.:	**324000625**
OWNER:	**Walinga Inc.**	PROJECT NAME:	**Carman Chrome Plating Design**
LOCATION:	**Carman, Manitoba**	DEPARTMENT:	**Hard Coating Line Area (HCLA)**
SPEC No.:	**DS-04**		

SCHEDULE

Drawing Ref No.	Type	Qty	ID
P-02	Pressure Transmitter	2	PT-CR1, PT-CR2
P-02	Temperature Sensing Element	1	TE (included with heater)
P-02	Current Transmitter / Controller	2	ITC (included with equipment)
P-02	Variable Frequency Drive	1	VFD-CR1
P-02	Solenoid Valve	1	S-CR1 (supplied by vendor)

SPECIFICATION NUMBER: DS-04

2021-06-16	**ISSUED FOR TENDER**	**TR**	**0**
DATE	ISSUED FOR	BY	REV. NO.

APPENDIX 3: DRAWINGS PACKAGE

	DRAWING NUMBER	REV.	DATE	DR.	DRAWING TITLE
1	M-01	2	JUN. 16, 2021	WJ	VENTILATION AND SUPPLY AIR SYSTEMS LAYOUT HCLA AREA
2	M-02	2	JUN. 16, 2021	WJ	VENTILATION SYSTEM ELEVATIONS HCLA AREA
3	M-03	2	JUN. 16, 2021	WJ	VENTILATION SYSTEM ELEVATIONS HCLA AREA
4	M-04	0	JUN. 16, 2021	WJ	VENTILATION SYSTEM ELEVATIONS HCLA AREA
5	P-01	2	JUN. 16, 2021	WJ	P&ID VENTILATION SYSTEMS HCLA AREA
6	P-02	0	JUN. 16, 2021	WJ	P&ID VENTILATION SYSTEM HCLA AREA
7					
8					
9					
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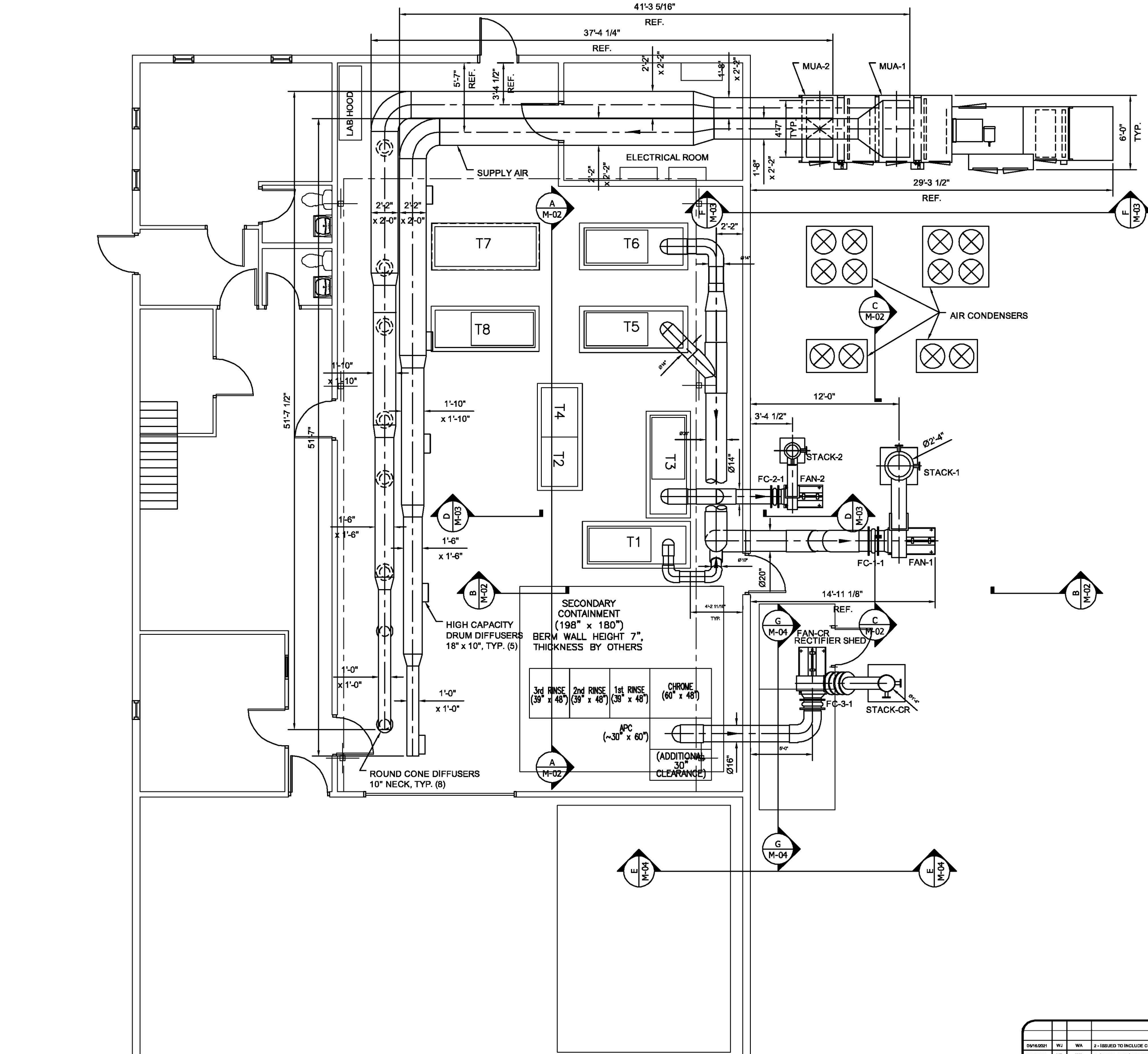
RAMBOLL		**DRAWING LIST** CHROME PLATING LINE DESIGN WALINGA INC. CARMAN, MANITOBA	PAGE **1**
DRAFTED BY: TR	DATE: JUN. 16, 2021		PROJECT: 324000625



1. FANS' PLATFORMS ARE DESIGNED BY OTHERS.
2. SEE FAN SPECIFICATION SP-01 SECTION 5 FOR FANS' DETAILS.
3. DUCTWORK AND FITTINGS LEADING TO THE STACK(STACK-CR) ARE PVC PIPING SCH. 4 (DIAMETERS ARE NOMINAL SIZES). THE STACKS ARE WRAPPED IN FRP.
4. DRAIN AND OTHER ACCESSORIES NOT SHOWN (e.g. HANGERS, SUPPORTS, ETC.); DESIGNED BY OTHERS.
5. FAN-CR AND STACK-CR'S STRUCTURAL DESIGN PROVIDED BY OTHERS.
6. ALL INSTRUMENTATION, DAMPERS, ETC. TO BE MOUNTED AS PER DRAWING P-01.
7. SEE DRAIN DATA SHEET FOR DRAIN DETAILS.
8. THE SYSTEM WAS DESIGNED, FABRICATED AND INSTALLED ACCORDING TO ALL APPLICABLE CODES AND STANDARDS INCLUDING:

- MANITOBA BUILDING CODE AND SPECIFICALLY "GROUP F, DIVISION 2 - MEDIUM HAZARD INDUSTRIAL OCCUPANCY"
- SMACNA - HVAC DUCT CONSTRUCTION STANDARDS
- ACGIH GUIDELINES "INDUSTRIAL VENTILATION: A MANUAL OF RECOMMENDED PRACTK FOR DESIGN".

[redacted]

DATE	DR.	CH.	REVISION
06/16/2021	WJ	WA	2 - ISSUED TO INCLUDE CHROME PLATING
11/02/2018	MB	WA	1 - ISSUED AS BUILT DRAWINGS
11/28/2017	MB	WA	0 - ISSUED FOR TENDER
11/17/2017	MB	WA	D - REVISED AS SHOWN
11/03/2017	MB	WA	C - REVISED AS SHOWN
09/22/2017	MB	WA	B - REVISED AS SHOWN
09/19/2017	MB	WA	A - REVISED AS SHOWN

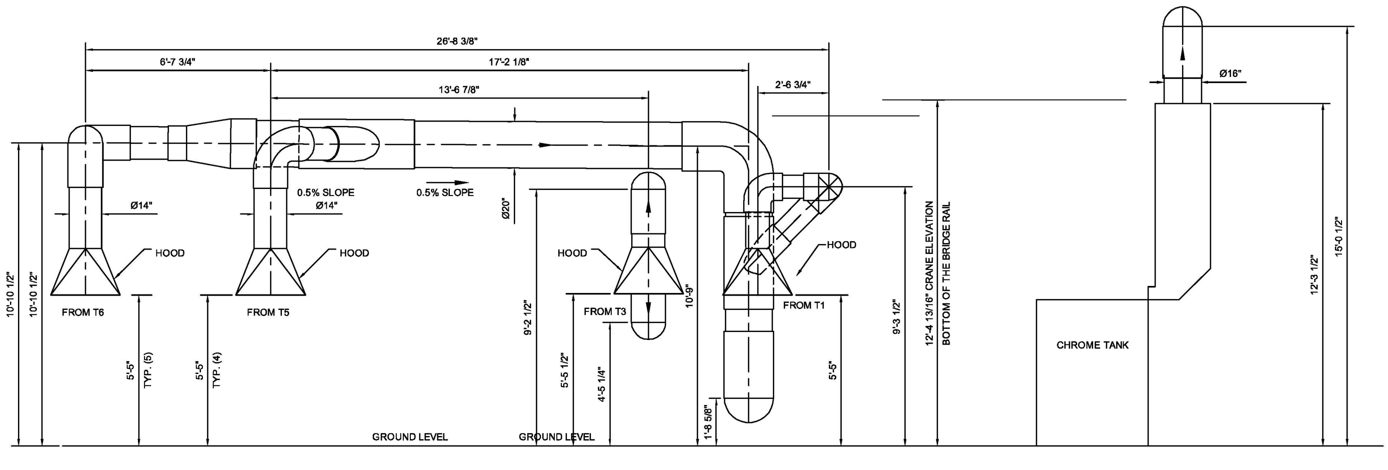
VENTILATION AND SUPPLY AIR SYSTEMS LAYOUT HCLA AREA

WALINGA INC.
CARMAN, MANITOBA

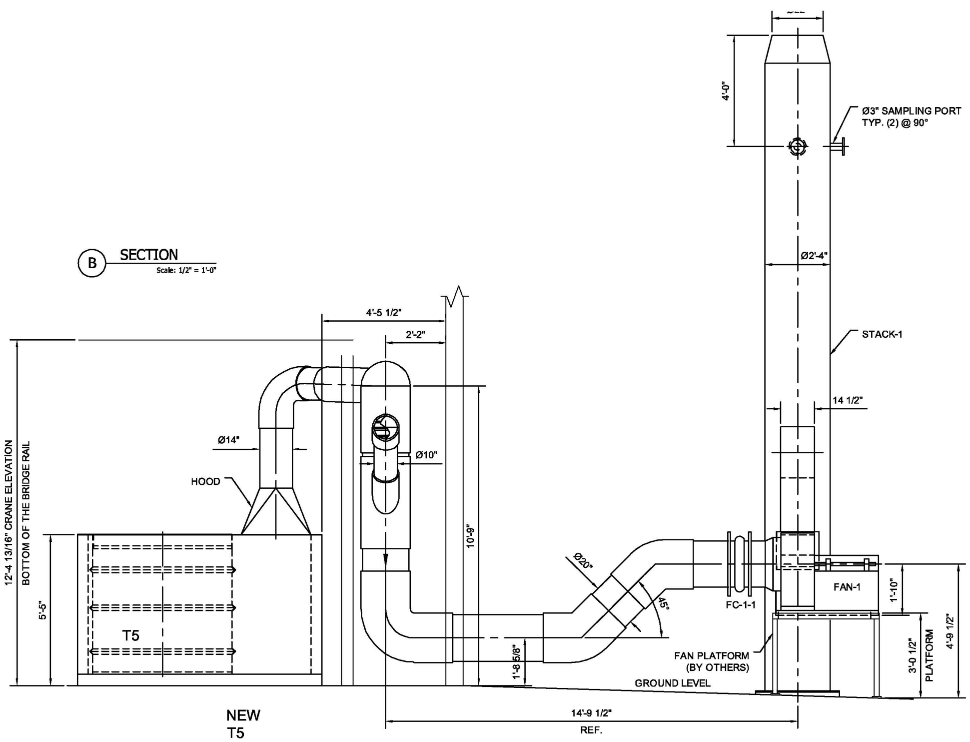
RAMBOLL

PREPARED BY: TR
DATE: SEP. 13, 2017
DRAFTED BY: MB
SCALE: 1/4" = 1'-0"
APPROVED BY: WA
PROJECT: 324000125

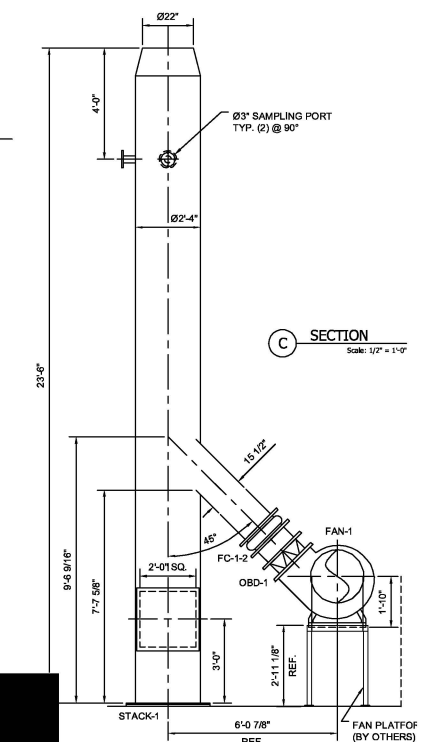
DWG NO.
M-01



A ELEVATION
Scale: 1/2" = 1'-0"



B SECTION
Scale: 1/2" = 1'-0"



C SECTION
Scale: 1/2" = 1'-0"

[redacted]

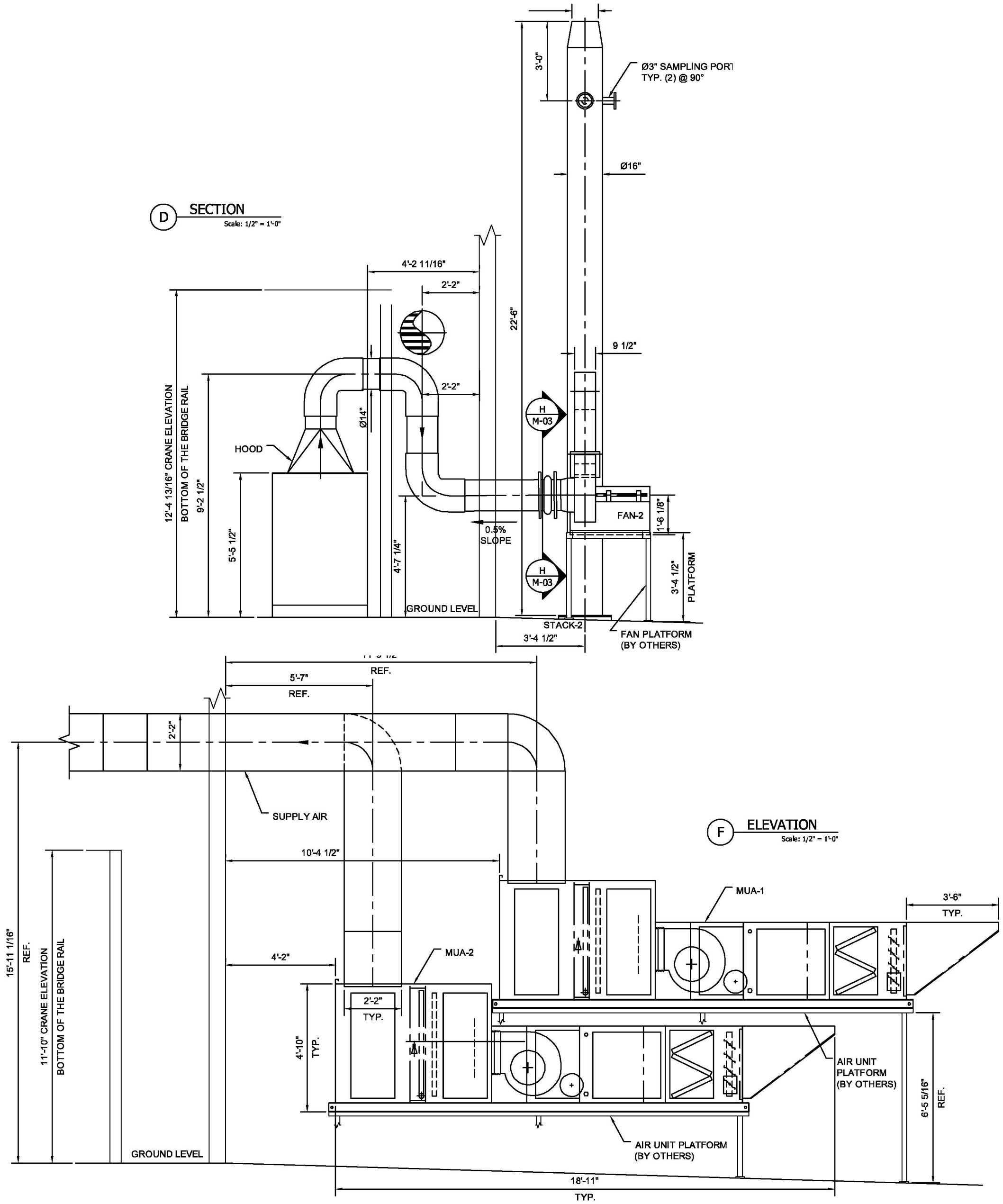
DATE	DR.	CH.	REVISION
08/16/2021	WJ	WA	2 - ISSUED TO INCLUDE CHROME PLATING
11/02/2018	MB	WA	1 - ISSUED AS BUILT DRAWINGS
11/28/2017	MB	WA	0 - ISSUED FOR TENDER
11/17/2017	MB	WA	C - REVISED AS SHOWN
09/22/2017	MB	WA	B - REVISED AS SHOWN
09/19/2017	MB	WA	A - REVISED AS SHOWN

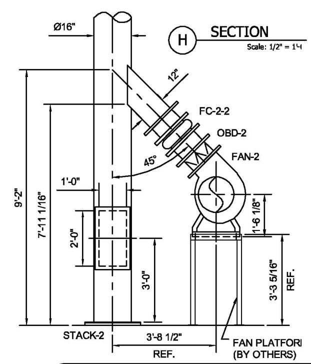
VENTILATION SYSTEM ELEVATIONS
HCLA AREA

RAMBOLL

WALINGA INC.
CARMAN, MANITOBA

PREPARED BY: MB	DATE: SEP. 13, 2017	DWG NO.
DRAFTED BY: MB	SCALE: 1/2" = 1'-0"	M-02
APPROVED BY: WA	PROJECT: 324000125	





[redacted]

DATE	DR.	CH.	REVISION
06/16/2021	WJ	WA	2 - ISSUED TO INCLUDE CHROME PLATING
11/02/2018	MB	WA	1 - ISSUED AS BUILT DRAWINGS
11/28/2017	MB	WA	0 - ISSUED FOR TENDER
11/17/2017	MB	WA	D - REVISED AS SHOWN
11/03/2017	MB	WA	C - REVISED ELEVATION F
09/22/2017	MB	WA	B - REVISED AS SHOWN
09/19/2017	MB	WA	A - REVISED AS SHOWN

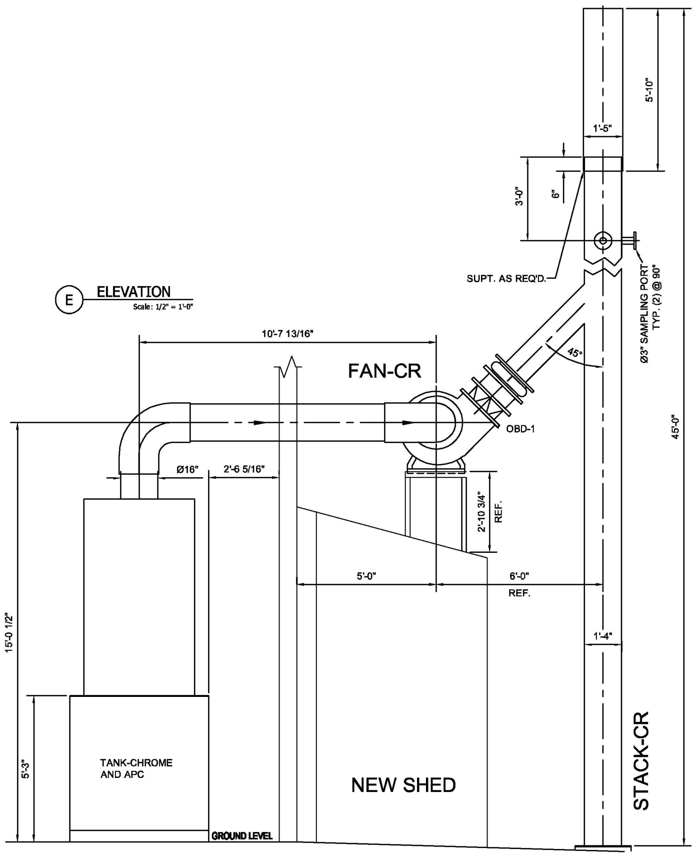
VENTILATION SYSTEM ELEVATIONS
HCLA AREA

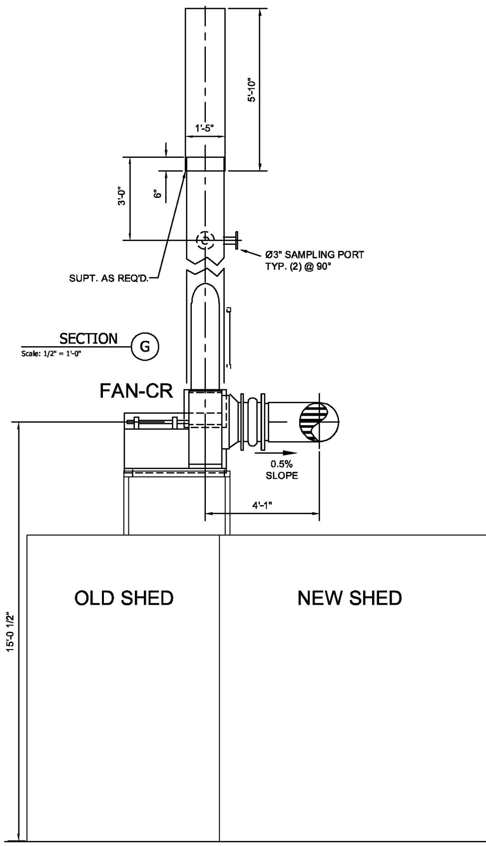
RAMBOLL

WALINGA INC.
CARMAN, MANITOBA

PREPARED BY: MB	DATE: SEP. 13, 2017	DWG NO.
DRAFTED BY: MB	SCALE: 1/2" = 1'-0"	**M-03**
APPROVED BY: WA	PROJECT: 324000125	

BJARRELL 6/15/21 [324000625 GENERAL LAYOUT & ELEVATIONS_PL_V3]
G:\DRF\ENVIRON\324000625





[redacted]

DATE	DR.	CH.	REVISION
06/16/2021	WJ	WA	2 - ISSUED TO INCLUDE CHROME PLATING

VENTILATION SYSTEM ELEVATIONS HCLA AREA

RAMBOLL

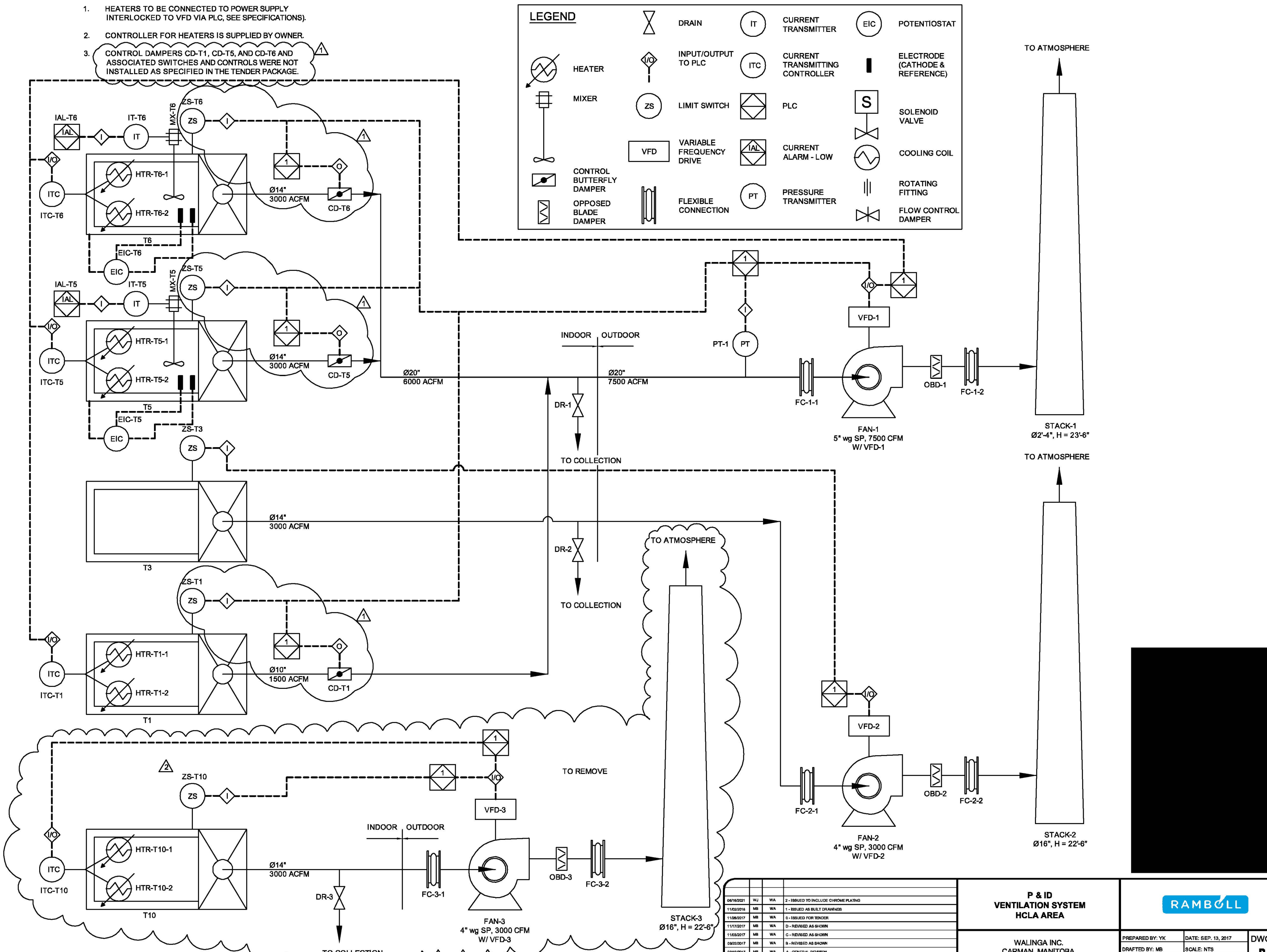
WALINGA INC.
CARMAN, MANITOBA

PREPARED BY: WJ	DATE: SEP. 13, 2017	DWG NO.
DRAFTED BY: WJ	SCALE: 1/2" = 1'-0"	**M-04**
APPROVED BY: WA	PROJECT: 324000125	

BJARRELL 6/16/21 [324000025 GENERAL LAYOUT & ELEVATIONS_PL_V3]
G:\DRF\ENVIRON\324000025

NOTES:

1. HEATERS TO BE CONNECTED TO POWER SUPPLY INTERLOCKED TO VFD VIA PLC, SEE SPECIFICATIONS).
2. CONTROLLER FOR HEATERS IS SUPPLIED BY OWNER.
3. CONTROL DAMPERS CD-T1, CD-T5, AND CD-T6 AND ASSOCIATED SWITCHES AND CONTROLS WERE NOT INSTALLED AS SPECIFIED IN THE TENDER PACKAGE.



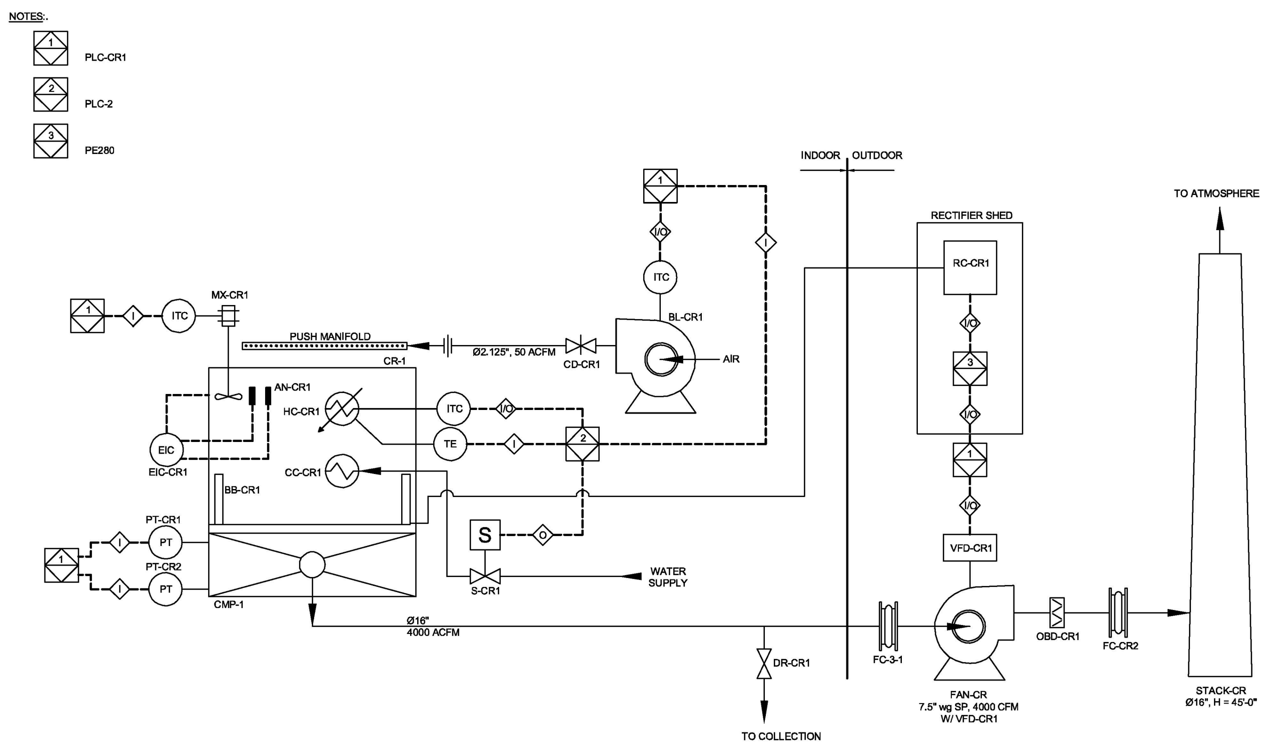
DATE	DR.	CH.	REVISION
06/16/2021	WJ	WA	2 - ISSUED TO INCLUDE CHROME PLATING
11/02/2018	MB	WA	1 - ISSUED AS BUILT DRAWINGS
11/28/2017	MB	WA	0 - ISSUED FOR TENDER
11/17/2017	MB	WA	D - REVISED AS SHOWN
11/03/2017	MB	WA	C - REVISED AS SHOWN
09/22/2017	MB	WA	B - REVISED AS SHOWN
09/19/2017	MB	WA	A - GENERAL REVISION

P & ID
VENTILATION SYSTEM
HCLA AREA

RAMBØLL

WALINGA INC.
CARMAN, MANITOBA

PREPARED BY: YK	DATE: SEP. 13, 2017	DWG NO.
DRAFTED BY: MB	SCALE: NTS	**P-01**
APPROVED BY: WA	PROJECT: CA12-00861A	



[redacted]

DATE	DR.	CH.	REVISION
06/16/2021	WJ	WA	0 - ISSUED TO INCLUDE CHROME PLATING
06/1/2021	WJ	TR	A - DRAFT FOR CLIENT REVIEW

P & ID
VENTILATION SYSTEM
HCLA AREA

WALINGA INC.
CARMAN, MANITOBA

PREPARED BY: TR	DATE: JUNE 1, 2021	DWG NO.
DRAFTED BY: WJ	SCALE: NTS	**P-02**
APPROVED BY: WA	PROJECT: CA12-00861A	

ENVIRONMENT
& HEALTH

DESIGN ADDENDUM #1

Project name **Carman Chrome Plating Line Design Specifications**
Project no. **324000625**
Client **Walinga Inc.**
To **Walinga Inc.**
Trevor Diljee
Ray Beukema
From **Ramboll Canada Inc.**
Taylor Roumeliotis, Ph.D., P.Eng.
Phillip Labarge, EIT

RE: Walinga Inc. Carman Chrome Plating Line Design Specifications Addendum #1

Date July 7, 2021

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https://ramboll.com

Ramboll Canada Inc. ("Ramboll"), on behalf of Walinga Inc. ("Walinga") issued a specification and drawing package on June 16, 2021 for a new hard chrome plating line in Walinga's hard coating line area (HCLA) shop ("design package").

Since issuing the design package, Walinga has determined that the new chrome tank, CR-1, should be 66″ (167.6 cm) long instead of the originally designed 60″ (152.4 cm) to better accommodate the submerged tank equipment (e.g. coils, mixer) as well as Walinga's largest parts to be plated. The new CR-1 tank dimensions will be 66″ x 48″ x 63″ [LxWxH].

This Addendum #1 serves to modify aspects of the design package impacted by this larger chrome tank, CR-1.

1 Plating Line Tanks

Walinga wants to increase the length of the chrome tank, CR-1, while maintaining the same general tank arrangement as specified in the design package's drawings. This requires the follows changes to accommodate this requirement:

1. Section 3.1.1 of Specification SP-01 provides the General Service and Requirements for the new chrome tank (CR-1). This tank's length shall be increased to 66″ (152.4 cm), such that the outer dimensions specified for tank CR-1 shall be revised to:

   66″ (152 cm) x 48″ (121 cm) x 63″ (160 cm) [LxWxH].
2. Section 3.2.1 of Specification SP-01 provides the General Service and Requirements for the new rinse tanks (CR-2, CR-3, and CR-4). These tanks' length shall be reduced to 38″ (96.5 cm) from 39″ (99 cm) to provide more space for the chrome tank, CR-1. That is, the outer dimensions specified for tanks CR-2, CR-3, and CR-4 shall be revised to:

   38″ (96.5 cm) x 48″ (121 cm) x 63″ (160 cm) [LxWxH].

   In total, these revised dimensions provide 3″ (7.6 cm) of additional space for the chrome tank within the same tank arrangement.

3. The center position of the chrome tank, CR-1, shall remain in place in Drawings M-01 and M-04. To maintain this center position, the larger chrome tank will extend 3” (7.6 cm) farther toward the outer wall (to the east).

2 Secondary Containment

The secondary containment berm shall be resized to accommodate the large chrome tank’s volume and adhere to the design guidance, M.R. 188/2001 and CCME (2003).

The secondary containment berm dimensions, as shown in Drawing M-01, shall be revised to 198” x 180”, with a berm wall height of 8”.

3 Exhaust Fans and Motors

The push-pull system must be resized for the larger surface area of the chrome tank, specifically:

1. Section 5.1.1 of Specification SP-01 provides the General Service and Requirements for the new blower for the push system serving the chrome tank (BL-CR1).
    - The gas volume shall be increased to 55 Aft^3/min. All other specified parameters remain unchanged.
2. Drawing P-02 presents the P&ID for the chrome line. The push manifold should be sized to 2.25” diameter or greater with a flow rate of 55 Aft^3/min. The associated balancing damper, CD-CR1, should be sized to the corresponding diameter and flow of the push manifold (i.e., ≥2.25”). Refer to DS-01 for other damper details, which remain the same.
3. Section 5.2.1 of Specification SP-01 provides the General Service and Requirements for the new exhaust fan for the chrome tank (FAN-CR). The following parameters shall be revised:
    - The gas volume shall be increased to 4,400 Aft^3/min.
    - The fan static pressure (FSP) shall remain at 7.5 in. H_2O.[1]

All other specified parameters remain unchanged.

4 Air Pollution Control System

The air pollution control system, CMP-1, serving the chrome tank must be resized to accommodate the 66” length of the chrome tank as well as the additional flow required by adequate fume capture, specifically:

1. Section 4.1.1 of Specification SP-01 provides the General Service and Requirements for the new chrome composite mesh pad, CMP-1, for the chrome tank. The following parameters shall be revised:
    - The gas volume shall be increased to 4,400 Aft^3/min (7,500 m^3/hr).
    - The length shall be increased to ≤ 66 inches.

All other specified parameters remain unchanged. Notably, the CMP-1 system must be capable of reducing hexavalent chromium compounds [Cr(VI)] in the exhaust to a concentration of 0.006 mg/dscm (maximum) at this revised flow rate.

5 Stack Design

The increased surface area of the chrome tank is expected to generate some additional Cr(VI) fume; although the additional air flow will effectively capture this fume and the exhaust concentration of Cr(VI)

[1] This FSP assumes that the increase in flow rate does not increase the pressure drop associated with CMP-1 from the assumed 3.5 in. H_2O. Additional pressure drop associated with CMP-1 beyond the assumed 3.5 in. H_2O will need to be added to this specified parameter.

shall be reduced to 0.006 mg/dscm (maximum), as specified above and in the design package. With an additional 400 cfm air flow (i.e., 4,400 cfm vs. 4,000 cfm originally designed) and a concentration of 0.006 mg/dscm, the peak emission rate may increase to 1.246×10^{-5} g/s from 1.133×10^{-5} g/s. However, the exit velocity from the stack will be proportionally higher and give more vertical momentum to the plume which will enhance its dispersion prior to impacting at ground-level.

A SCREEN3 dispersion model was run for this revised air flow rate and emission, and the resulting peak off-property concentrations were calculated as 1.73×10^{-3} µg/m^3 on a one-hour average and 1.38×10^{-4} µg/m^3 on an annual average, based on a 0.08 conversion from one-hour to annual average following Manitoba and Ontario air dispersion modelling guidance. These results are almost identical to the results in Ramboll's air dispersion modelling report and do not affect its conclusions.[2] A copy of the revised SCREEN3 dispersion modelling output is found in Attachment 1.

In light of these results, the stack design in the design package will not be revised.

[2] Ramboll, 2021. Walinga Inc. Carman Chrome Plating Line Air Dispersion Modelling Report. June 17, 2021. Project no. 324000625.

Attachment 1

Screen3 Dispersion Model Output

07/05/21
13:14:06

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 13043 ***

Walinga_4400cfm

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	0.124500E-04
STACK HEIGHT (M)	=	13.7000
STK INSIDE DIAM (M)	=	0.4318
STK EXIT VELOCITY (M/S)	=	14.2000
STK GAS EXIT TEMP (K)	=	298.0000
AMBIENT AIR TEMP (K)	=	293.0000
RECEPTOR HEIGHT (M)	=	0.0000
URBAN/RURAL OPTION	=	RURAL
BUILDING HEIGHT (M)	=	5.5900
MIN HORIZ BLDG DIM (M)	=	15.2000
MAX HORIZ BLDG DIM (M)	=	36.6000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 0.109 M**4/S**3; MOM. FLUX = 9.241 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
50.	0.3619E-03	1	3.0	3.1	960.0	19.70	14.50	7.45	NO
100.	0.1408E-02	1	2.0	2.0	640.0	22.70	26.98	14.18	NO
200.	0.1612E-02	3	2.0	2.1	640.0	22.61	23.76	14.26	NO
300.	0.1705E-02	3	1.0	1.0	320.0	31.52	34.67	20.96	NO
400.	0.1599E-02	3	1.0	1.0	320.0	31.52	44.94	26.93	NO
500.	0.1469E-02	4	1.5	1.6	480.0	25.40	36.30	18.60	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 50. M:

257.	0.1727E-02	3	1.5	1.5	480.0	25.58	30.05	18.03	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED

```
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 ********************************************
 *  SUMMARY OF TERRAIN HEIGHTS ENTERED FOR  *
 *    SIMPLE ELEVATED TERRAIN PROCEDURE     *
 ********************************************

      TERRAIN        DISTANCE RANGE (M)
       HT (M)       MINIMUM     MAXIMUM
   -------         --------    --------
          0.           50.        500.

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    0.000        CONC (UG/M**3)     =    0.000
  CRIT WS @10M (M/S) =    99.99        CRIT WS @10M (M/S) =    99.99
  CRIT WS @ HS (M/S) =    99.99        CRIT WS @ HS (M/S) =    99.99
  DILUTION WS (M/S)  =    99.99        DILUTION WS (M/S)  =    99.99
  CAVITY HT (M)      =     5.85        CAVITY HT (M)      =     5.59
  CAVITY LENGTH (M)  =    24.29        CAVITY LENGTH (M)  =    15.84
  ALONGWIND DIM (M)  =    15.20        ALONGWIND DIM (M)  =    36.60

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S.  CONC SET = 0.0

****************************************
      END OF CAVITY CALCULATIONS
****************************************


     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------  ---------   -------
SIMPLE TERRAIN      0.1727E-02      257.        0.


***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
```

****

Intended for
Walinga Inc.

Plant Location
Box 1790, 70 3rd Ave NE
Carman, Manitoba
R0G 0J0

Date
June 2021

WALINGA INC.
CARMAN CHROME PLATING LINE AIR DISPERSION MODELLING REPORT

RAMBOLL Bright ideas. Sustainable change.

WALINGA INC.
CARMEN CHROME PLATING LINE AIR DISPERSION MODELLING REPORT

Project name	**Walinga – Chrome Plating Line Design – Carmen, MB**
Project no.	**324000625**
Recipient	**Walinga Inc.**
Revision	**0**
Date	**June 17, 2021**
Prepared by	**Phillip Labarge**
Checked by	**Taylor Roumeliotis**
Approved by	**Taylor Roumeliotis**
Description	**Air Dispersion Modelling Report for New Chrome Plating Line**

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Mississauga, ON L5N 6S2
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https://ramboll.com

CONTENTS

LIST OF TABLES

APPENDICES

1. INTRODUCTION AND BACKGROUND

Walinga Inc. (Walinga) is a leading Canadian manufacturer of customized truck bodies and trailers, built primarily for the agricultural industry. Walinga operates a custom truck body and a pneumatic conveying system manufacturing facility at 70 3rd Ave NE in Carman, Manitoba (Carmen Facility).

Under the Classes of Development Regulation, the Carman Facility is categorized as a "Manufacturing" and a "Manufacturing and Industrial plant"-type development.

The facility currently operates under Manitoba Environmental Act License No. 3197, issued August 24th, 2016. A Notice of Alteration (NoA) for a nickel-based coating line was approved on September 29th, 2017.

1.1 Purpose and Scope of Report

In the hard coating line area (HCLA) shop of the west building at the Carmen Facility, Walinga currently operates a nickel-based coating process referred to as the "CorVor plating line". Walinga plans to install and commission a new hard chrome plating line in Summer 2021 ("chrome plating line") in the HCLA. Once the chrome plating line is commissioned, Walinga plans to operate the CorVor plating line at a reduced capacity, removing the process' strip tank, T10, and plans to use the chrome plating line as its primary plating process.

This air dispersion modelling report is intended to support a NoA proposal for the proposed chrome plating line by assessing the potential offsite impact from all air emissions resulting from the proposed chrome plating process. This report was prepared in accordance with the "Guidelines for Air Dispersion Modelling in Manitoba" (or "Manitoba Guidelines").[1]

1.2 Process Description – Chrome Plating Line

The new chrome plating line will consist of four (4) new tanks including: one (1) chromic-sulphuric acid plating tank (chrome tank) and three (3) water rinse tanks (rinse tanks 1 to 3). There will be a countercurrent rinse water flow from rinse tank 3, flowing through the other rinse tanks to the chrome tank.

The chrome tank will be equipped with submersible heating coils, submersible cooling coils, a mechanical mixer, busbars from a rectifier, and conforming anodes. The rinse tanks will not have any ancillary equipment.

Due to the presence of potentially hazardous chemicals in the chrome tank, CR-1, a "push-pull" ventilation system and air pollution control (APC) system will be installed on the tank to capture all fume generated by the plating process and remove it from the exhaust air stream prior to emission to atmosphere through a single stack, STACK-CR.

[1] Manitoba Conservation, 2006. DRAFT Guidelines for Air Dispersion Modelling in Manitoba. Air Quality Section Programs Division. November 2006.

Table 1-1 summarizes the tanks, associated equipment, and operating details including expected chemicals in the tanks used for the proposed chrome plating line.

Table 1-1: Summary of Tanks and Equipment for the Chrome Plating Line.

<table>
<tr><th>Tank Name (ID)</th><th>Description</th><th>Operating Temp. (ºC)</th><th>Ancillary Equipment</th><th>Tank Contents</th></tr>
<tr><td>Chrome Tank (CR-1)</td><td>Chromic acid tank</td><td>55 to 75 ºC</td><td>• Cooling coils
• Heating coils
• Busbars
• Conforming anodes
• Mixer</td><td>• Chromic acid
• Sulphuric acid
• Plating additives (HEEF® KR or HEEF® 25)
• Fume suppressant (Fumetrol® 21 LF)</td></tr>
<tr><td>Rinse Tank 1 (CR-2)</td><td>Cold water rinse / Chrome tank top-up</td><td>Room</td><td>None</td><td rowspan="3">• Water with negligible, trace concentrations of the components in CR-1</td></tr>
<tr><td>Rinse Tank 2 (CR-3)</td><td>Cold water rinse</td><td>Room</td><td>None</td></tr>
<tr><td>Rinse Tank 3 (CR-4)</td><td>Final water rinse</td><td>Room</td><td>None</td></tr>
</table>

A site plan showing the Carman Facility's buildings and property boundaries is found in Appendix 1. A plan and elevation view drawing of the HCLA and proposed arrangement for the chrome plating line, fan and stack are also found in Appendix 1.

1.3 Operating Schedule

It is anticipated the plating operations will not be in continuous operation, with the plating process regularly shutting down in the evening and overnight. The associated ventilation system will also be shut down for regular maintenance. However, to be conservative and less restrictive on operating schedules, this report assumes that the plating process and its emissions occur 24 hours per day, 7 days per week, 52 weeks per year.

2. IDENTIFICATION OF SOURCES AND CONTAMINANTS

Tank CR-1, the chrome plating tank, is the only expected source of air emissions from the proposed chrome plating line. As part of its operation, the chrome plating tank will produce a fume (aerosol) consisting of the plating bath's components. The fume is captured by a local ventilation system, controlled by an inline APC system, and emitted through a single point source, STACK-CR. The main contaminants expected in this fume are:

- Hexavalent Chromium Compounds (CAS RN 18540-29-9);
- Sulphuric Acid (CAS RN 7664-93-9); and
- Proprietary Compounds in the bath additives.

Both the plating bath additive (HEEF® KR or HEEF® 25) and the fume suppressant (Fumetrol® 21 LF) contain a proprietary mixture of compounds. The Safety Data Sheets (SDSs) for these compounds state that they do not contain any hazardous compounds. See Section 3.2 for more details on how the potential environmental impacts from these compounds were assessed.

While there are other sources of air emissions to the environment at the Carmen facility (e.g., the CorVor ventilation stacks), no other sources emit the compounds listed above in significant quantities from the buildings on the south property (Block 3 in site plan, Appendix 1). Some hexavalent chromium emissions are expected from the painting operations and truck repair operations involving stainless steel welding in the building on the north property (Block 2 in site plan, Appendix 1), located more than 120 metres away. Given the expected quantities and distance from the HCLA area, this emission inventory and associated screening level dispersion modelling assessment will only consider the emissions through STACK-CR (see Chapter 5 for modelling selection and details).

3. REGULATORY CRITERIA

3.1 Ambient Air Quality Criteria

The contaminants identified above, chromic acid and sulphuric acid, both have corresponding Manitoba ambient air quality criteria (MAAQC)[2]. However, both criteria are guidelines for hourly average concentrations, which does not directly address the possible chronic effects of hexavalent chromium and Manitoba Guidelines indicate that a health risk assessment may be required for air pollutants that are carcinogens or have other chronic long-term health effects.

Manitoba Guidelines also recommends including air quality criteria from other jurisdictions in the absence of MAAQC, which is considered the case here for the potential chronic long-term effects of chromic acid emissions. For these reasons, this air dispersion modelling evaluation includes the province of Ontario's Air Contaminants Benchmark (ACB)[3] for hexavalent chromium, which is based on an annual average concentration, and for completeness the sulphuric acid ACB (note that Ontario ACB are a recommended source for air quality criteria in Manitoba Guidelines).

Table 3-1 below presents the selected ambient air quality criteria used for this air dispersion modelling evaluation.

Table 3-1: Selected Ambient Air Quality Criteria for this Evaluation

Contaminant	Information Source	Averaging Time	Concentration [$\mu g/m^3$]	Notes
Chromium Compounds (hexavalent forms)	MAAQC	1-hr	4.5	Guideline
	Ontario ACB List	Annual	0.00014	Standard
Sulphuric Acid	MAAQC	1-hr	100	Guideline
	Ontario ACB List	24-hr	5	Standard

3.2 Proprietary Compounds

The chrome plating line will utilize some additives which do not explicitly state what they are made of due to their proprietary nature. The SDSs of these additives state that they do not contain any hazardous components. However, the quantity of air emissions could be large so to be conservative, Ramboll also followed Ontario's *de minimus* concentration threshold approach to demonstrate that the air emissions of the proprietary compounds would cause negligible offsite impacts, as per Ontario's Guideline A-10.[4] More specifically, to assess whether these proprietary

[2] Manitoba Sustainable Development, July 2005. "Manitoba Ambient Air Quality Criteria".
[3] Ontario Ministry of the Environment, Conservation and Park, 2018. "Air Contaminants Benchmarks (ACB) List", version 2.0. Available from: https://files.ontario.ca/air_contaminants_benchmarks_list_2018.xlsx. Accessed June 15, 2021.
[4] Ontario Ministry of the Environment, Conservation and Parks, March 2018. "Procedure for Preparing an Emission Summary and Dispersion Modelling Report, [Guideline A-10]", version 4.1, Table B-2A.

compounds were negligible, Ontario's *de minimus* concentration of 0.1 μg/m^3 (24-hour average) was used by:

1) Confirming with the chemical manufacturer that their proprietary compounds did not contain contaminants with Ontario ACB with limits lower than the *de minimus* concentration (see Appendix 2 for details); and
2) Estimating the offsite impact given the emission estimation described in Section 4 and comparing the modelled offsite concentration to the 0.1 μg/m^3 (24-hour average) threshold (Section 6).

4. EMISSION ESTIMATES

The only source of air emissions from the chrome plating process is the chrome plating tank, CR-1. CR-1 generates a fume which is captured by a local ventilation system, and treated by an inline APC system, CMP-1, before being emitted to the environment through a single stack, STACK-CR.

The APC system, CMP-1, used to remove the chromic-sulphuric acid fume from the exhaust stream consists of a series of composite mesh pads (CMPs) and a final fiber-bed HEPA filter. The equipment manufacturer has provided a guarantee that the outlet concentration of hexavalent chromium compounds will be less than 0.006 milligrams per dry standard cubic meter (mg/dscm). Even though the concentration is guaranteed to be less than 0.006 mg/dscm as hexavalent chromium, this concentration (0.006 mg/dscm) was used directly to estimate the emission rate of hexavalent chromium at the expected exhaust flow rate of the ventilation system, to be conservative.

In addition to hexavalent chromium compounds, emissions of sulphuric acid and other plating bath additives are expected in the emissions generated by the chrome tank. These contaminants will be contained in the aerosol droplets of the plating bath solution, the fume, and therefore should exist in the same proportions that they are in the plating solution. The concentration of hexavalent chromium compounds (in the form of chromic acid) in the plating solution is expected to be ~250g/L (~20.83% by volume), whereas the concentration of sulphuric acid and all other bath additives are much less than 10% by volume. To be conservative, and to allow for operational flexibility in the concentration of these additional compounds, it was assumed that sulphuric acid and any proprietary plating solution additives were contained in the plating solution at a concentration of 10% by volume for the purposes of estimating emissions. Detailed equations summarizing these methodologies are presented below.

Equation 1: Calculation of hexavalent chromium emission rate

$$ER_{CrVI} = EF_{CrVI} \times Conversion\ Factor \times Q$$
$$ER_{CrVI} = 0.006 \frac{mg}{dscm} \times \left(\frac{1\ g}{1000\ mg}\right) \times 1.89 \frac{m^3}{s}$$
$$ER_{CrVI} = 1.13x10^{-5} g/s$$

Where,
ER_{CrVI} is the emission rate of hexavalent chromium compounds, g/s
EF_{CrVI} is the emission factor based on the guarantee by the APC manufacturer, mg/dscm
Q is the exhaust flow rate of the local ventilation system for the chrome plating line, m^3/s

Equation 2: Calculation of other contaminant emission rates

$$ER_x = ER_{CrVI} \times \left(\frac{C_x}{C_{CrVI}}\right)$$
$$ER_{sulphuric\ acid} = 1.13x10^{-5} g/s \times \left(\frac{10\%vol}{20.83\%vol}\right)$$
$$ER_{sulphuric\ acid} = 5.44x10^{-6} g/s$$

Where,
ER_{CrVI} is the emission rate of hexavalent chromium compounds, g/s
ER_x is the emission rate of contaminant 'x', g/s
C_{CrVI} is the concentration of hexavalent chromium compounds in the plating solution, %volume
C_x is the concentration of contaminant 'x' in the plating solution, %volume

Note that these calculations do not correct the exhaust volume (actual flow rate) to the dry, standardized flow rate used in the guaranteed hexavalent chromium emission limit. The exhaust stream is expected to be at a temperature above room temperature and will be saturated with moisture. Correcting to dry, standard conditions would lower the flow rate and the associated emission estimate. Therefore, the emission calculation as presented are conservative. Table 4-1 below presents the final calculated maximum emission rates from STACK-CR.

Table 4-1: Emission Rates from Chrome Plating Process and STACK-CR

Compound	CAS RN	Maximum Emission Rate	
		g/hr	Tonne/yr(1)
Chromium Compounds (hexavalent forms)	18540-29-9	0.0408	3.57E-04
Sulphuric Acid	7664-93-9	0.0196	1.71E-04
Other Additives	not applicable	0.0196	1.71E-04

Notes:
(1) Assuming 24 hours/day, 365 days/year operation

For this screening level assessment and to be overly conservative, only a 100% load scenario was considered (i.e. maximum emission rate = average emission rate).

5. MODELLING METHODOLOGY

In accordance with Manitoba Guidelines, a screening model assessment was undertaken in this report. The most recent version of the U.S. EPA screening model, SCREEN3 (Version 13043) was used to estimate the maximum 1-hour average ground-level concentrations resulting from the air emissions related to the chrome plating line. SCREEN3 is the recommended screening level dispersion model by Manitoba Conservation.

A single point source, STACK-CR, was modelled with the emission rate that was calculated for hexavalent chromium compounds (see Table 4-1). The estimated offsite impacts of other contaminants were estimated by scaling the hexavalent chromium modelling result according to the ratio between the hexavalent chromium emission rate and the corresponding emission rate for that compound.

The full meteorology and simple (flat) terrain options were selected, with all receptors located at the same elevation as the stack base (i.e., 0 meters above stack base). Rural dispersion coefficients were also specified.

STACK-CR is located just east of the assembly shop, Block 3, Lot 1, see Appendix 1 for more details. STACK-CR is located ~50 meters (m) from the nearest property boundary, so the receptor spacing was specified to be automatically generated between 50m and 500m of the stack. This methodology automatically identifies and specifies the distance at which the maximum concentration occurs and presented the modelled concentration at this distance.

Building downwash effects were accounted for in the model. STACK-CR has two nearby buildings, the assembly shop and the machine shop, which are both tapered roof buildings which are ~50 (feet) ft x 120 ft (15.2m x 36.6m), are 20 ft (6.09m) and 16.7 ft (5.08m) above ground level at the peak and eave, respectively. The arithmetic average height of the building, 18.3 ft (5.59m), and dimensions of 15.2m x 36.6m were used to specify the building in the model.

Stack parameters were modelled based on the specification provided in the chrome line's design report[5], and an assumed temperature of 25°C (298 K).[6] The stack parameters used in the model are presented below in Table 5-1.

Table 5-1: Modelled Source Parameters

Source	Flow Rate, m^3/s (cfm)	Diameter, m (in)	Velocity, m/s	Height Above Grade, m (ft)	Stack Temperature, K
STACK-CR	1.89 (4000)	0.4318 (17)	12.9	13.7 (45.0)	298

[5] Ramboll Canada Inc., 2021. "Walinga Inc. Carmen Chrome Plating Line Design Specifications", Revision 0.
[6] An exhaust temperature of 25°C (298 K) is expected to give conservative dispersion modelling results since the chrome plating tank (and other tanks in the HCLA area) are heated, which will raise the exhaust temperature above 25°C and give the plume slightly more buoyancy.

The SCREEN3 model calculates the maximum 1-hour averaged ground-level concentration at off-property locations, however many of the criteria presented in Table 3-1 have longer averaging periods. Hourly maximum concentrations predicted by the SCREEN3 model were converted to 24-hour average and annual average concentrations using factors of 0.4 and 0.08 respectively.[7]

The output file of the SCREEN3 model used in this report can be found in Appendix 3.

[7] Ontario Ministry of the Environment, Conservation and Parks, February 2017. "Air Dispersion Modelling Guideline for Ontario [Guideline A-11]", Version 3.0, Table 4-1: Common Averaging Period Conversion Factors. Available from: https://files.ontario.ca/admgo-id50_aoda_v2b.pdf. Accessed June 16, 2021.

6. RESULTS AND ASSESSMENT

The results of the dispersion modelling are presented in Table 6-1 on the following page. The location of the maximum predicted ground-level concentration was 302 m from the stack.

These modelling results indicate that both sulphuric acid and chromic acid's off-property air quality impacts are below their respective air quality criteria. While hexavalent chromium compounds do approach the Ontario annual standard of 0.00014 $\mu g/m^3$ (99% of criteria), given the conservative nature of the estimation of the emission rate calculation, the screening level model, the conservative assumption that the process will continuously operate all year, etc., this estimate is expected to be very conservative. In practice, Ramboll anticipates that the off property impacts of the chrome plating line will be well below the selected ambient air quality criteria.

These results also indicate that any plating bath additives currently used at the facility result in negligible air quality impacts, with their modelled off-property ground-level concentration being less than 1% of the *de minimus* concentration threshold.

6.1 Good Engineering Practice (GEP) Stack Height Analysis

Despite the STACK-CR height being slightly less than the good engineering practice (GEP) stack height for possible unacceptable dispersion (e.g. 13.98 m GEP vs. 13.72 m design), the screening level assessment adequately demonstrates that the currently proposed stack height is sufficient to adequately disperse pollutants to acceptable levels at all off-site locations.

Table 6-1: Air Dispersion Modelling Results

Compound	CAS RN	Peak Modelled Concentrations			Criteria Basis	Standard	Averaging Time	% of Criteria
		1-hr Average µg/m³	24-hr Average µg/m³	Annual Average µg/m³		µg/m³		
Chromium Compounds (hexavalent forms)	18540-29-9	1.73E-03	6.93E-04	1.39E-04	MAAQC	4.5	1-hr	0.04%
					Ontario ACB List Standard	0.00014	annual	99.0%
Sulphuric Acid	7664-93-9	8.31E-04	3.33E-04	6.65E-05	MAAQC	100	1-hr	0.001%
					Ontario ACB List Standard	5	24-hr	0.01%
Other Additives (de minimus)	not applicable	8.31E-04	3.33E-04	6.65E-05	Ontario De Minimus	0.1	24-hr	0.3%

7. CONCULSIONS

The screening level assessment presented in this report demonstrates that the proposed chrome plating line can operate continuously without causing an exceedance of an MAAQC or Ontario ACB used to assess chronic long-term air quality impacts.

We trust that the above information supports your decision for Walinga's Notice of Alteration proposal. Should you have any questions or require further information, please contact the undersigned.

Respectfully submitted,

Ramboll Canada Inc.

[redacted]

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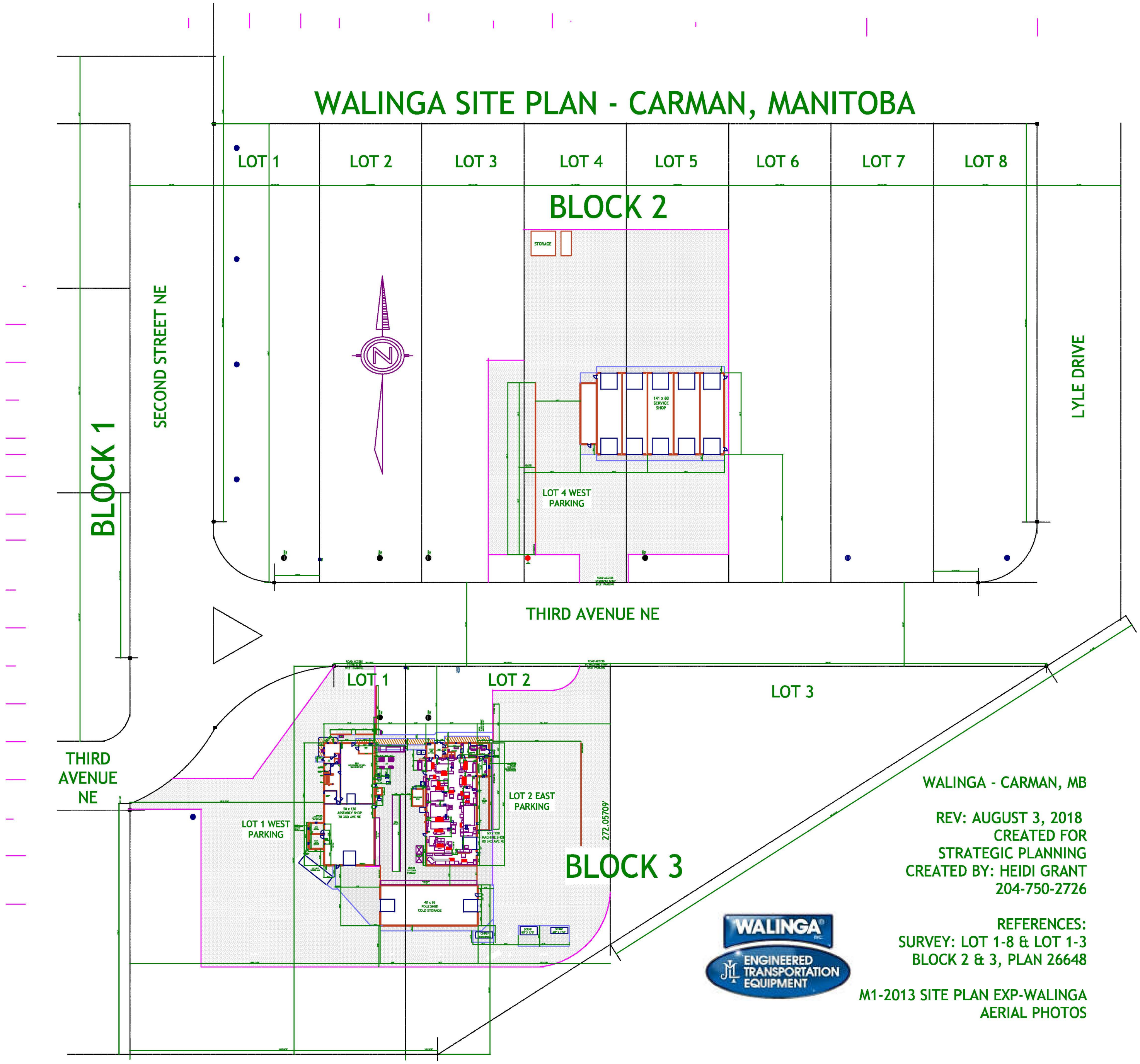
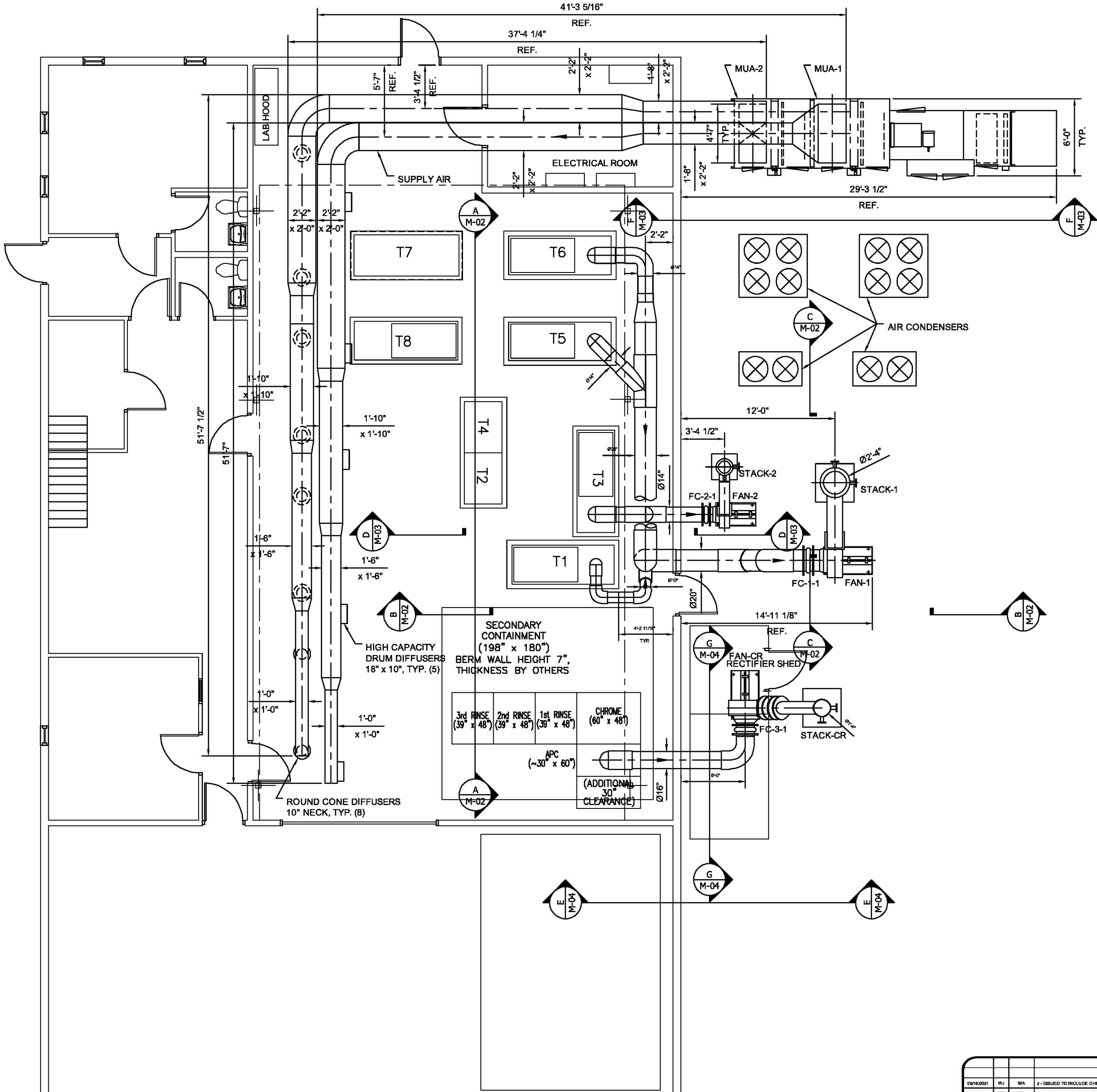
APPENDIX 1: SITE PLAN AND DRAWINGS



WALINGA SITE PLAN - CARMAN, MANITOBA
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
BLOCK 2
BLOCK 1
SECOND STREET NE
LYLE DRIVE
LOT 4 WEST PARKING
THIRD AVENUE NE
LOT 1
LOT 2
LOT 3
THIRD AVENUE NE
LOT 1 WEST PARKING
LOT 2 EAST PARKING
272.05709'
BLOCK 3
WALINGA - CARMAN, MB
REV: AUGUST 3, 2018
CREATED FOR
STRATEGIC PLANNING
CREATED BY: HEIDI GRANT
204-750-2726
REFERENCES:
SURVEY: LOT 1-8 & LOT 1-3
BLOCK 2 & 3, PLAN 26648
M1-2013 SITE PLAN EXP-WALINGA
AERIAL PHOTOS



1. FANS' PLATFORMS ARE DESIGNED BY OTHERS.
2. SEE FAN SPECIFICATION SP-01 SECTION 5 FOR FANS' DETAILS.
3. DUCTWORK AND FITTINGS LEADING TO THE STACK(STACK-CR) ARE PVC PIPING SCH. 4 (DIAMETERS ARE NOMINAL SIZES). THE STACKS ARE WRAPPED IN FRP.
4. DRAIN AND OTHER ACCESSORIES NOT SHOWN (e.g. HANGERS, SUPPORTS, ETC.); DESIGNED BY OTHERS.
5. FAN-CR AND STACK-CR'S STRUCTURAL DESIGN PROVIDED BY OTHERS.
6. ALL INSTRUMENTATION, DAMPERS, ETC. TO BE MOUNTED AS PER DRAWING P-01.
7. SEE DRAIN DATA SHEET FOR DRAIN DETAILS.
8. THE SYSTEM WAS DESIGNED, FABRICATED AND INSTALLED ACCORDING TO ALL APPLICABLE CODES AND STANDARDS INCLUDING:

- MANITOBA BUILDING CODE AND SPECIFICALLY "GROUP F, DIVISION 2 - MEDIUM HAZARD INDUSTRIAL OCCUPANCY"
- SMACNA - HVAC DUCT CONSTRUCTION STANDARDS
- ACGIH GUIDELINES "INDUSTRIAL VENTILATION: A MANUAL OF RECOMMENDED PRACTIC FOR DESIGN".

DATE	DR.	CH.	REVISION
06/16/2021	WJ	WA	2 - ISSUED TO INCLUDE CHROME PLATING
11/02/2018	MB	WA	1 - ISSUED AS BUILT DRAWINGS
11/28/2017	MB	WA	0 - ISSUED FOR TENDER
11/17/2017	MB	WA	D - REVISED AS SHOWN
11/03/2017	MB	WA	C - REVISED AS SHOWN
09/22/2017	MB	WA	B - REVISED AS SHOWN
09/19/2017	MB	WA	A - REVISED AS SHOWN

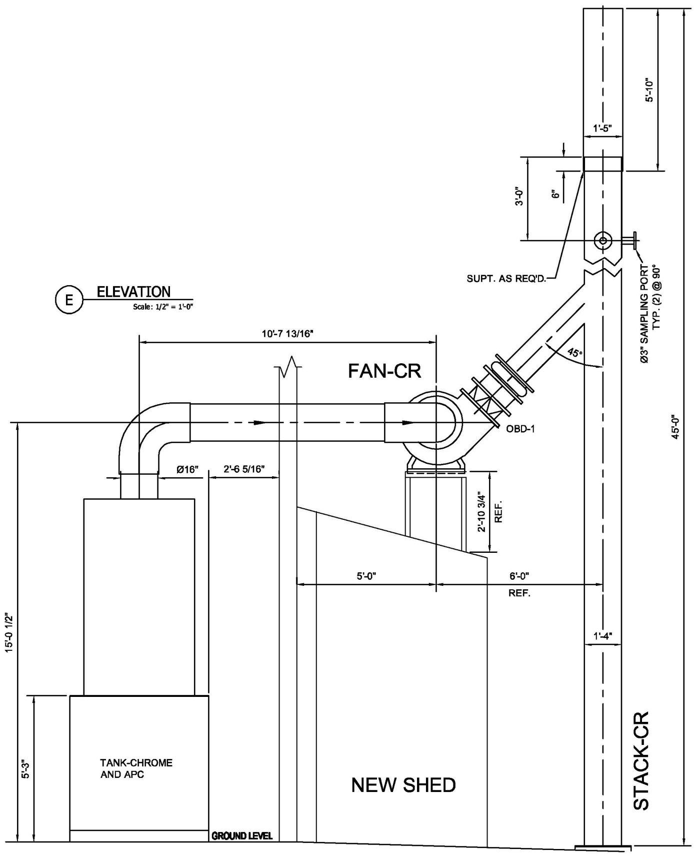
VENTILATION AND SUPPLY AIR SYSTEMS LAYOUT HCLA AREA

RAMBOLL

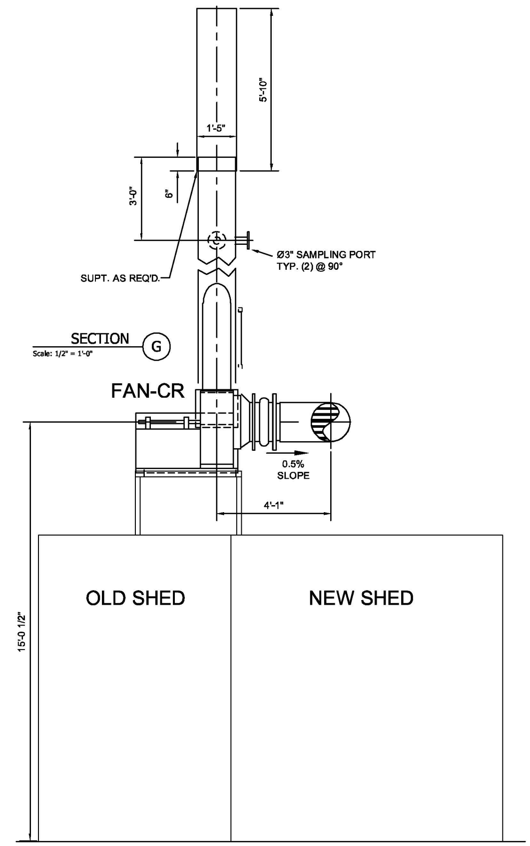
WALINGA INC.
CARMAN, MANITOBA

PREPARED BY: TR	DATE: SEP. 13, 2017	DWG NO.
DRAFTED BY: MB	SCALE: 1/4" = 1'-0"	**M-01**
APPROVED BY: WA	PROJECT: 324000125	

E ELEVATION
Scale: 1/2" = 1'-0"



SECTION G
Scale: 1/2" = 1'-0"



DATE	DR.	CH.	REVISION
06/16/2021	WJ	WA	2 - ISSUED TO INCLUDE CHROME PLATING

VENTILATION SYSTEM ELEVATIONS HCLA AREA

RAMBOLL

WALINGA INC.
CARMAN, MANITOBA

PREPARED BY: WJ	DATE: SEP. 13, 2017	DWG NO.
DRAFTED BY: WJ	SCALE: 1/2" = 1'-0"	M-04
APPROVED BY: WA	PROJECT: 324000125	

APPENDIX 2: LIST OF CONTAMINANTS WITH CRITERIA BELOW THE DE MINIMUS THRESHOLD

Chemical Name	CAS Number
(4-Chlorophenyl)cyclopropylmethanone, O-[(4-nitrophenyl)methyl] oxime	94097-88-8
1,1-Dimethylhydrazine	57-14-7
1,2-Diphenylhydrazine	122-66-7
2,4-/2,6-Dinitrotoluene mixture	25321-14-6
2,4-Dinitrotoluene	121-14-2
Aluminum nitride	24304-00-5
Asbestos (fibres > 5µm in length)	1332-21-4
Benzidine	92-87-5
Benzo(a)pyrene	50-32-8
Benzo(a)pyrene [as a surrogate of total Polycyclic Aromatic Hydrocarbons (PAHs)]	50-32-8
Beryllium and compounds	7440-41-7
Bis(chloromethyl) ether	542-88-1
Bromodichloromethane	75-27-4
Cadmium (and Cadmium Compounds)	7440-43-9
Chloramine	10599-90-3
Chloromethyl methyl ether	107-30-2
Chloroplatinic acid	16941-12-1
Chromium compounds (hexavalent forms)	7440-47-3
Cupferron	135-20-6
Detergent enzyme (Subtilisin)	1395-21-7
Dichlorodiphenyl dichloroethane (DDD)	72-54-8
Diethylstilbesterol	56-53-1
Dimethylaminoazobenzene	60-11-7
Dimethylcarbamoyl chloride	79-44-7
Dimethylvinyl chloride	513-37-1
Dioxins, Furans and Dioxin-like PCBs	n/a
Diquat dibromide	85-00-7
Fentanyl citrate	990-73-8
Glycidaldehyde	765-34-4
Hexachlorobenzene	118-74-1
Hexamethylene diisocyanate (HDI) monomer	822-06-0
Isoflupredone acetate	338-98-7
Methyl acrylate	96-33-3
Methyl hydrazine	60-34-4
Michler's Ketone	90-94-8
Mirex	2385-85-5
Nickel and Nickel Compounds	7440-02-0
Paraquat dichloride	1910-42-5
p-Chloro-o-toluidine	95-69-2
Polybrominated Biphenyls (PBBs)	n/a
Polychlorinated Terphenyls (PCTs)	61788-33-8
Sulphur pentafluoride	5714-22-7
t-Butyl peroxyacetate	107-71-1
Tetrachlorophthalic anhydride	117-08-8
Tris(1-aziridinyl) phosphine sulphide	52-24-4
Tris(2,3-Dibromopropyl) phosphate	126-72-7
Uranium and Uranium compounds	7440-61-1
Urethane	51-79-6

APPENDIX 3: SCREEN3 OUTPUT

05/26/21
10:02:43

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 13043 ***

WALINGA_CR

```
SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =     0.113267E-04
   STACK HEIGHT (M)       =      13.7160
   STK INSIDE DIAM (M)    =       0.4318
   STK EXIT VELOCITY (M/S)=      12.8910
   STK GAS EXIT TEMP (K)  =     298.0000
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =       5.5900
   MIN HORIZ BLDG DIM (M) =      15.2000
   MAX HORIZ BLDG DIM (M) =      36.6000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =    0.099 M**4/S**3;  MOM. FLUX =    7.616 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC              U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)    HT (M)   Y (M)   Z (M)  DWASH
-------  ----------  ----  -----  -----  ------  ------  ------  ------  -----
    50.  0.3875E-03    1     3.0    3.1   960.0   19.16   14.48    7.41    NO
   100.  0.1397E-02    1     2.0    2.0   640.0   21.88   26.95   14.14    NO
   200.  0.1634E-02    2     1.0    1.0   320.0   30.05   36.47   20.76    NO
   300.  0.1732E-02    3     1.0    1.0   320.0   29.90   34.60   20.85    NO
   400.  0.1559E-02    3     1.0    1.0   320.0   29.90   44.89   26.85    NO
   500.  0.1455E-02    4     1.0    1.0   320.0   29.64   36.43   18.85    NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND    50. M:
   302.  0.1732E-02    3     1.0    1.0   320.0   29.90   34.91   21.03    NO
```

```
DWASH=   MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

*******************************************
*  SUMMARY OF TERRAIN HEIGHTS ENTERED FOR  *
*    SIMPLE ELEVATED TERRAIN PROCEDURE     *
*******************************************

     TERRAIN      DISTANCE RANGE (M)
      HT (M)      MINIMUM    MAXIMUM
     -------      --------   --------
         0.          50.       500.

***************************************
    *** REGULATORY (Default) ***
   PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
        (BRODE, 1988)
***************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)      =    0.000       CONC (UG/M**3)      =    0.000
  CRIT WS @10M (M/S) =    99.99        CRIT WS @10M (M/S) =    99.99
  CRIT WS @ HS (M/S) =    99.99        CRIT WS @ HS (M/S) =    99.99
  DILUTION WS (M/S)  =    99.99        DILUTION WS (M/S)  =    99.99
  CAVITY HT (M)      =     5.85        CAVITY HT (M)      =     5.59
  CAVITY LENGTH (M)  =    24.29        CAVITY LENGTH (M)  =    15.84
  ALONGWIND DIM (M)  =    15.20        ALONGWIND DIM (M)  =    36.60

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S.  CONC SET = 0.0

***************************************
     END OF CAVITY CALCULATIONS
***************************************


    ***************************************
    *** SUMMARY OF SCREEN MODEL RESULTS ***
    ***************************************

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
```

```
--------------  -----------  ---------  -------
SIMPLE TERRAIN   0.1732E-02    302.       0.


*************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
*************************************************
```