Detroit Assembly Complex Mack
Odor Investigation, Analysis, and Mitigation Plan

FCA US LLC

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Executive Summary

The Air Quality Division ("AQD") within the Michigan Department of Environment, Great Lakes, and Energy ("EGLE") alleged that unreasonable odors emanated from the operations at FCA's Detroit Assembly Complex Mack ("Mack") and resulted in a nuisance. This *Odor Investigation, Analysis, and Mitigation Plan* ("Plan") summarizes key actions taken by FCA to identify and address the potential for unreasonable odors near Mack.

In the "investigation" phase, FCA:

1. Conducted an internal review of operations at the site to identify and promptly address operations that could cause odors; and,

2. Engaged third-party engineering firms to provide their expert analysis, which included odor emission dispersion modeling, to guide FCA's decision-making about mitigation actions.

Based on the results of the odor investigation, FCA and its team analyzed the actions most effective at mitigating the potential for unreasonable odors near Mack. Based on this investigation and analysis, FCA and its team identified a list of Mitigation Actions to be implemented at the site.

Mitigation Actions include:

- Routing the Primer Ambient Flash zones to the existing emissions control system - a concentrator and regenerative thermal oxidizer ("RTO") - which was completed December 19, 2021;

- Installation of an additional, new RTO and ducting to abate odors from the clear coat flash and observation zones of both Mack coating lines;

- Route the clean air exhaust from the existing concentrator to the stack of the new RTO to improve dispersion; and,

- Utilization of odor reduction technologies for the primer paint cooling tunnel, topcoat paint cooling tunnel and the sludge tank exhaust, as appropriate.

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1.0 Background

AQD issued Violation Notices ("VNs") to FCA on September 20, 2021 and November 3, 2021. The VNs alleged noncompliance with General Condition No. 6 of Permit-to-Install No. 14-19a based on an "unreasonable interference with the comfortable enjoyment of life and property" caused by nuisance odors detected by AQD in the area near the Mack facility. FCA responded to those notices on October 11, 2021 and November 24, 2021, respectively.

To address the odor concerns, FCA committed to (1) conduct an investigation of potential sources of odor from Mack operations, and (2) develop a plan to mitigate odor sources and reduce the potential for unreasonable nuisance odors. This *Odor Investigation, Analysis, and Mitigation Plan* ("Plan") describes FCA's odor monitoring activities and paint process evaluation. It also describes the comprehensive odor testing and modeling exercise conducted by third-party experts and the resulting mitigation actions.

Notably, FCA retained the services of specialty engineering firms with experience in odor monitoring, modeling of odor dispersion, and odor mitigation strategies. FCA also developed a criteria for interpretation of dispersion modeling results to select mitigation actions that help ensure that, once the mitigation strategies are implemented, the site operations will not result in an objectionable odor (defined as level 3 or higher in the EGLE qualitative odor scale) off site. Based on the results of the odor source and dispersion study, FCA developed an odor mitigation plan which includes specific actions to be implemented at the site to limit objectionable odors.

It is important to note that sampling by FCA and US EPA during 2021 has shown that odors reaching the community do not represent a health risk to residents. Additional air quality data is currently pending, and FCA will continue to report ambient air monitor data to EGLE and share it with the community.

2.0 Investigation and Analysis

This section describes the activities completed by FCA to investigate potential odor sources including processes and emission points; the odor dispersion modeling analysis used to evaluate the potential effect of identified odor sources on neighboring properties; and the analysis of mitigation options for the reduction of odor migration.

2.1 Odor Monitoring, Process Evaluation, and Presumptive Actions

Following notice of the odor concern in the community, FCA immediately initiated an investigation to identify operations that could be a cause of odors and implemented appropriate response activities.

FCA initiated an odor complaint review process where each complaint is logged, and the conditions that existed at the time of the complaint are recorded and evaluated. These conditions include the atmospheric conditions such as wind direction, wind speed, and temperature (taken from the FCA on-site weather station), the production activity at the time of the complaint, and any potentially pertinent non-production operations ongoing at that time. Additionally, when a notice of a complaint is received in a timely manner, FCA personnel conduct an evaluation of odors off-site. This process aided the company in identifying potential sources of odor.

In addition, FCA initiated a routine odor monitoring program to determine trends, locations, and sources of potential odors from plant operations. This odor monitoring program includes observations along the edge of the Mack property. Observations are made several times a day. The atmospheric conditions and operations of the facility are noted and recorded during monitoring activities.

FCA also evaluated the painting process at the facility to identify operations or practices that could contribute to odors leaving the facility, whether from a stack or building ventilation system. Based on that evaluation, FCA took certain presumptive actions to immediately reduce the risk of odors from plant operations, as described below.

- FCA initiated a procedure which requires any large access doors along the west side of the building to be closed when not in use, which will be simplified and reliably implemented with the installation of automatic exterior roll-up doors.
- Tarps were installed on the sludge dewatering boxes located in the paint sludge room to help minimize interior odors.
- An automated chemical feeding system has been installed on the paint sludge system to ensure optimized management of the process, which will help to reduce odors from the paint sludge process.
- FCA is monitoring the painting process equipment very closely to identify any operating conditions which might cause odors to escape into the general building atmosphere and potentially be discharged through the building ventilation system.
- Automated booth monitoring systems have been installed to notify operators of adverse conditions before the system becomes out of balance.

2.2 Odor Emissions Monitoring

RWDI AIR Inc. (RWDI) was retained by FCA to conduct source sampling. Source testing was completed to assist in the identification and quantification of potentially odorous sources of emissions at the Mack facility due to neighborhood concerns. The data provided in this report was used to complete air dispersion modeling and to identify potential solutions to address the odor concern. (See abridged RWDI Report in Appendix A).

A total of 152 odor samples were collected at various sources of potential emissions at the facility. The odor samples were taken on October 18th, 19th, 20th, 21st, 25th, November 4th, 9th, 10th, 16th, 18th, 19th, 22nd and 24th of 2021. The odor concentrations, hedonic tone (scale of how pleasant or unpleasant an odor is; +10 is very pleasant and -10 is very unpleasant) as well as characteristics of the odors were noted.

Odor concentrations were provided as detectable concentration (i.e., Detection Threshold) and recognition concentration (i.e., Recognition Threshold) as defined below:

- Detection Threshold: the dilution levels required to dilute the sample with odor free air until 50% of the odor panelists can *confirm the odor is present* in a sampling port
- Recognition Threshold: the dilution levels required to dilute the sample with odor free air until 50% of the odor panelists *can identify and recognize the odor is present* in a sampling port

This section outlines the results from the sampling program. As noted, the results were used to determine the potential odors released off-site as well as any mitigation recommendations. The odor measurement results are provided in the RWDI report in Appendix A.

Odor Sampling Procedures

OSTC Method ON-6 “Determination of Odour Emissions from Stationary Sources” was utilized to collect all undiluted (neat) samples using an evacuated lung sampler, which contained a Teflon® bag wherein the stack gas was drawn via a Teflon® line. The bags were covered to avoid sunlight exposure and to minimize potential photochemical reactions. Blank samples were also submitted to the laboratory. Neat sampling techniques are used when source temperatures and moisture content are low and source odor concentration must be within the dilution range of the olfactometer.

A diagram of the neat odour sampling equipment set up is provided below.

The following equipment was utilized:

- Sample probe/line (clean Teflon, stainless-steel)
- Lung Chamber

- Sample bags (10L tedlar)
- Vacuum Pump

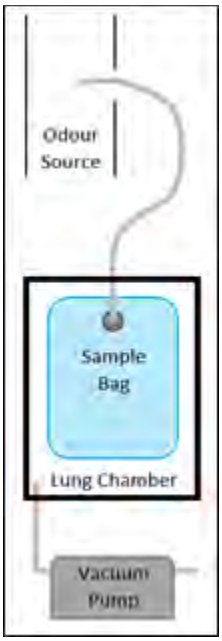

Figure: Lung Chamber (Undiluted) Sampling

The sample line was connected to the inlet of the lung chamber and inserted into the stack/duct. The sample line was located at a single point near the center of the stack/duct. Ports/openings were sealed to prevent dilution of the gas stream with ambient air. On field notes, the sample location, sample ID, time of sampling, date of sampling and comments regarding any field dilutions or moisture present in the sample bags were recorded.

A sample bag is connected to the sample line inside the lung chamber and the chamber is sealed. The sample bag is purged at least three (3) times by doing the following:

- Start vacuum pump;
- Allow bag to fill;
- Remove bag from lung chamber; and,
- Empty all contents from bag.

After completing three (3) purges, a sample is collected. The vacuum pump flow rate is adjusted so that the sample is collected over a 5- to 10-minute period. Once the sample is collected, the sample bag is sealed, checked for leaks, and placed in an opaque container (ex. black garbage bag) to avoid exposure to sunlight.

<u>Odor Analysis Methodology</u>

To handle the odor sample volumes, COVID-19 restrictions at the laboratories, and panel

availability, three (3) laboratories were utilized. Odor samples were delivered to Pinchin Environmental, Environmental Odour Consulting Corporation and St. Croix Sensory, Inc. for odor panel analysis within 24 hours of collection. The laboratory analysis includes the determination of detection threshold for odor, and this value was used to calculate odor emission rates as outlined in the Reference Method. Analysis also included recognition levels, hedonic tone and characteristic. Laboratory results and methodology are provided in Appendix A.

The odor samples are presented to the panelists using the "triangular forced-choice" method, described by ASTM E679-19, "Standard Practice for Determination of Odour and Taste Thresholds by a Forced-Choice Ascending Concentration Series Method of Limits". Each panelist evaluated the odor by "sniffing" the diluted odor samples presented by the Olfactometer. At each dilution level, the panelist "sniffed" three sample presentations, two of which were blank, odor free samples and one that contained the odorous air. The panelist was then asked to identify which of the three presentations was different from the other two by recording a "guess," "detect" or "recognize" response as defined by ASTM E679-19. A "guess" response was recorded when the assessor could not distinguish between any of the presentations. A "detect" response was recorded when the assessor could differentiate the odorous sample from the two blanks, and "recognize" was recorded when the assessor could identify and describe the odorous sample.

As per BS EN 13725:2003, each sample assessment began with the Olfactometer diluting the odorous sample to sub-detection levels. The odor sample and two blanks were then presented to one panelist, who "sniffed" the three presentations and recorded their response. The concentration of odorous gas was then doubled and re-presented to the same assessor with two blanks. Again, the assessor "sniffed" the three presentations and recorded their response. The process continued with the concentration of odorous gas increasing until the panelist had correctly detected the odor in at least two consecutive presentations as described by BS EN 13725:2003. The process was repeated for each panelist until all samples were evaluated.

Sample analysis was conducted "blind"; neither the panelist nor the test administrator knew which port would deliver the odor sample. Panelist's results were recorded and analyzed using the Olfactometer.

The odor reports include the following information:

- The panel(s) odor threshold, the unique numeric or alphanumeric ID of each of the odor evaluators, and the individual odor evaluator threshold value list containing at least the 10 most recent individual threshold estimates.
- Any odor evaluator excluded during this program, due to odor sensitivity concerns, was identified (using the unique numeric or alphanumeric ID) in the odor evaluation report.

- Arrival condition of the samples at the laboratory.
- The dilution presentation steps of the odor and blank samples for the odor evaluators.

Odor Evaluation Parameters

Odor Threshold Values – Detection Threshold (DT)

The detection threshold (DT) is the dilution ratio at which 50% of the panelists correctly detected the odor. DT, as defined by ASTM E679-19, is synonymous with the MECP definition of an odor threshold value (ED50) and the BS EN 13725:2003 definition of odor concentration (COD). That is, the DT represents the amount of dilution required for the odor to be just detectable. Since DT values are dimensionless, pseudo-dimensions of odor units per unit volume (i.e., odor units per cubic meter [OU/m^3]) are often used for reporting purposes.

In accordance with BS EN 13725:2003, individual threshold estimates (ZITE) were calculated as the geometric mean of the lowest dilution ratio where the odor could not be detected and the dilution ratio at which the panelist correctly detected the odor. Where a detection response could not be established at the Olfactometer's dilution limit, it was assumed that the panelist would have detected the odor at a dilution ratio half that of the limit, and the ZITE was calculated. The sample COD was then calculated as the geometric mean of the ZITE values.

Odor Threshold Values – Recognition Threshold (RT)

The recognition threshold (RT), as defined by ASTM E679-19, is the dilution ratio at which the assessor first detects the odor's character (i.e., the odor "smells like…") or the dilution level at which 50% of the panelists correctly recognized the odor. RT was evaluated following the same procedure as outlined for DT except once the assessor correctly detected the odor, the process continued with the concentration of odorous gas increasing until the panelist had correctly recognized the odor in at least two consecutive presentations. The process was repeated for each panelist until all samples were evaluated. Calculations for RT were based on the BS EN 13725:2003 procedures for the determination of COD where the individual recognition threshold estimates were calculated as the geometric mean of the lowest dilution ratio where the odor could not be recognized and the dilution ratio at which the panelist correctly recognized the odor. Where a recognition response could not be established at the Olfactometer's dilution limit, it was assumed that the panelist would have recognized the odor at a dilution ratio half that of the limit, and the individual recognition threshold estimate was calculated. The sample RT was then calculated as the geometric mean of the individual recognition threshold estimates.

Stack Velocity, Temperature, and Volumetric Flow Rate Determination

The exhaust velocities and flow rates were determined following the US EPA Method 1 & 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and digital manometer. Volumetric flow rates were determined following the equal area method as outlined in US EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type-k thermocouple in conjunction with a digital temperature indicator.

Stack gas composition was confirmed using a Fyrite. Moisture was determined either based on historical source testing data or wet/dry bulb techniques. Many of the sources were sampled more than once during the program. The flow rate determination was completed once during the survey and data was used to estimate odor emission rates for the remainder of the samples collected. Details on the flow rate determination are provided in Appendix A.

Quality Assurance/Quality Control Activities

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measures included detailed documentation of field data, equipment calibrations for measured parameters, completion of Chain of Custody forms when submitting laboratory samples, and submission of field blank samples to the laboratories. Samplers were bench tested and calibrated in RWDI's office prior to field deployment. Chain of custody forms were completed and submitted along with the samples to the laboratory.

Sampling media was provided or prepared by the laboratory responsible for its subsequent analysis. Quality control and quality assurance measures were recorded and are included in the final report. Pitot Tube Calibration records and detailed RWDI field notes are provided in Appendix A.

Operating Conditions

Operating conditions during the sampling were monitored by Mack personnel. Information on the production rates during testing is provided in Appendix A.

Odor Sampling Results

A total of 42 sources were evaluated for odor potential. Appendix A contains a summary of the following:

- Sample identification
- Sample date
- Time sample was collected
- Paint Shop production data (daily)
- Hourly production rate during test time

- Odor concentration
- Odor emission rate
- Odor characteristic
- Hedonic tone

The following table summarizes the sources and number of samples collected from each source during the program:

Source	No. of Samples	Source	No. of Samples	Source	No. of Samples
Clearcoat 2 Observation Stack	7	Clearcoat 1 Observation Stack	11	Concentrator Clean Air Stack	7
Rapid Repair	6	Sludge Tank Exhaust Stack	6	Desorb Purge Air Exhaust	4
Tutone Observation Stack	4	Basecoat 1 Observation Stack	4	Basecoat 2 Observation Stack	6
Spot Prime Exhaust Stack	4	Phosphate Stage 2B Exhaust	6	Prime Oven 1 & 2 Cooling Tunnel Exhaust	6
Clearcoat Oven 1 & 2 Cooling Tunnel	6	Phosphate Air Entrance Exhaust	4	3rd Floor Wall Vent Northwest Wall #1	4
3rd Floor Wall Vent Northwest Wall #2	4	Roof Exhaust #2	2	Roof Exhaust #4	2
E-Coat Oven 1 & 2 Cooling Tunnel Exhaust	6	Phosphate Stage 5 Exhaust	6	Roof Exhaust #5	4
Roof Exhaust #6	3	Phosphate Stage 9 Exhaust	6	E-Coat Stage 3 UF Dip	4
E-Coat Stage 1 Bypass Exhaust	2	1st Floor Side Wall Vent N6	2	Sludge Room Garage Door	2
North Corridor Side Wall Vent 8	1	North Corridor Side Wall Vent 9	1	RTO Outlet	6
Side Wall Vent 1 RTO/Elevator	1	Side Wall Vent 10 RTO/Elevator	1	Roof Exhaust #7	2

Source	No. of Samples	Source	No. of Samples	Source	No. of Samples
Roof Exhaust #3	2	Roof Exhaust #1	2	Clearcoat 1 Oven Purge Exhaust	1
Clearcoat 2 Oven Purge Exhaust	1	Prime 1 Oven Purge Exhaust	1	Prime 2 Oven Purge Exhaust	1
E-Coat 1 Oven Purge Exhaust	1	E-Coat 2 Oven Purge Exhaust	1	North Exhaust 1st Floor	2

2.3 Odor Dispersion Modeling

FCA utilized an outside specialty engineering firm to complete the modeling of odor dispersion and migration, which utilized the results of the odor testing program to evaluate the potential impact on neighboring properties and the effectiveness of odor mitigation strategies. The odor dispersion modeling program is described in more detail below.

Odor Dispersion Modeling Protocol

The recommended dispersion model in the US EPA's "Guideline on Air Quality Models" ("Guideline") (Appendix W to 40 CFR 51) is AERMOD, the dispersion modeling program developed by the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC). The AERMOD modeling system incorporates planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. AERMOD is used to predict impact concentrations for various air pollutants in comparison to various federal and state applicable air quality thresholds. Odor modeling is an outgrowth of air pollutant dispersion modeling used to predict downwind concentrations of odor from various sources such as stacks, vents, and area sources. AERMOD version 2112 was used in the odor modeling analyses.

The following default regulatory modeling options were used in this demonstration:

- elevated terrain algorithms requiring input of terrain height data
- stack-tip downwash (except for building downwash cases)
- calms processing routines
- missing data processing routines

Site Characteristics

The Mack facility is within the confines of the City of Detroit, Wayne County, Michigan. The facility is situated east of St. Jean Street, and bordered by Mack Avenue to the south,

Conner Street to the east, and Warren Avenue to the north. Neighboring properties are primarily heavy industry and residential.

Topography

Dispersion modeling uses data that represents the dispersion of pollutants in rural or urban areas. The Guideline presents the procedures for determining the appropriate dispersion coefficients. It indicates that the selection of rural or urban dispersion coefficients should follow "*one of the procedures suggested by Irwin to determine whether the character of an area is primarily urban or rural*." The Guideline goes on to indicate that "*of the two methods, the land use procedure is considered more definitive*". Therefore, the land use method was used to determine the appropriate dispersion coefficients for use with the modeling.

The land use procedure is identified in 7.2.1.1(b)(i) of the Guideline and states:

> "Classify the land use within the total area, A_o, circumscribed by a 3-km radius circle about the source using the meteorological land use typing scheme proposed by Auer. If land use types I1, I2, C1, R2, and R3 account for 50 percent or more of A_o, use urban dispersion coefficients; otherwise, use appropriate rural dispersion coefficients."

The area circumscribed by a 3-km radius surrounding the Mack facility comprises greater than 50% of land types I1, I2, C1, R2, and R3. Therefore, modeling options for urban areas were used in the dispersion modeling analyses.

Terrain Elevation

As noted above, the AERMOD dispersion model is capable of accounting for terrain elevation when calculating impact concentrations. To ensure that the results of the modeling analyses were as accurate as possible, terrain elevations were included in the modeling analyses. The elevations were based upon Digital Elevation Model (DEM) terrain data gathered by the United States Geological Survey (USGS). The DEM data is obtained from the USGS's National Elevation Dataset which can be accessed via the internet and the 'National Map Viewer'.

Stack Height and Building Downwash Consideration

The AERMOD dispersion model considers the influence of building structures on exhaust stack plumes. A building will have an influence on an exhaust plume if the distance between the two is less than five times the height or width (whichever is smaller) of the building.

The location of the influencing structures at Mack relative to the exhaust stacks and building vents were calculated using the US EPA Building Profile Input Program - Prime (BPIP-Prime) version 04274BPIP-Prime calculates the projected influence of building

widths and heights depending upon wind direction for use in the building downwash algorithms of the AERMOD model.

Meteorological Data

The most recent five years of available surface and upper air meteorological data (2016-2020) recorded at the nearest National Weather Service (NWS) Station to the facility was used to estimate ambient air impacts. The surface air meteorological data was recorded at the Detroit City Airport (DET) located in Detroit, Michigan, station number 14822. The upper air data was recorded at NWS station in White Lake, Michigan. The meteorological data used in the AERMOD calculations is based upon one-minute readings from the NWS Automated Surface Observing System (ASOS). Pursuant to EGLE procedure, the meteorological data was processed using the adjusted frictional velocity (u*) to improve model performance during periods of low winds/stable conditions. The meteorological data was downloaded from the EGLE Internet site.

Receptors

Receptor positions (i.e., locations where pollutant impact concentrations are calculated) were established based on the US EPA definition of ambient air, that is, "that portion of the atmosphere, external to buildings, to which the general public has access." It is the US EPA's policy that the portion of air exempt from being considered ambient air is that which is owned or controlled by the source, where the source employs measures, which may include physical barriers, that are effective in precluding access to the land by the general public.

Based on the US EPA definition of ambient air, an initial set of receptors with spacing of approximately 25 meters was placed along fence and/or property lines of the facility and extended to 100 meters beyond the fence line. To ensure that the locations of the maximum ambient air impact concentrations will be identified, additional receptor grids with a spacing of 100 meters, extending to 500 meters, and 250 meters extending to 4,000 meters beyond the fences were utilized.

Ambient air impact concentrations for comparison to regulatory thresholds (e.g., NAAQS, state air toxics) are typically calculated at ground level. For modeling used to predict odor concentrations the “flagpole” option for AERMOD receptors, which places the receptor at a specific height above ground level, was used. For the odor modeling analyses, the receptors used a flagpole height of 1.5 m, which is used to approximate the average height of human olfactory senses (i.e., nose). The location of the calculated air pollutant impact concentrations are expressed in Universal Transverse Mercator (UTM) coordinates (Zone 14, NAD83).

Averaging Period

The meteorological data used in AERMOD is obtained from one-minute ASOS readings. However, the data is processed for use in AERMOD and ultimately results in data for

each hour of the year. Because of this, the shortest time period for which AERMOD can calculate a predicted impact concentration is 1 hour.

Because of the transient nature of odors, a 1-hour average concentration is too long a period to adequately predict concentrations which are perceived by the applicable population. Therefore, odor modeling is normally completed to ascertain a 10-minute average impact concentration.

In order to convert 1-hour concentrations to a concentration with a shorter averaging period the following equation is used:

- For a 10-minute averaging period this equates to a factor of 1.65

Therefore, the AERMOD model was set up with an emission to concentration conversion of 1.65. The inputs of process and stack emissions in OU/s result in OU/m^3 with the appropriate 10-minute averaging period.

Odor Dispersion Modeling Inputs

In addition to the parameters listed in the sections above, and physical parameters such as height, diameter, temperature, exhaust flow rate of exhaust stacks, an emission rate of odors from various sources at the facility must be input into the model to estimate the maximum odor concentrations at the fence line and beyond into the surrounding area. Emission rates of odors for modeling are based upon the concentration of odors in the various stacks (OU/m3) and the measured air flow rate of the stack (m3/s). Multiplying the two values provides an odor emission rate in OU/s.

To complete the dispersion modeling input profile, FCA completed the odor monitoring program described in Section 2.2 of this report, designed to evaluate the odor emission rates from many sources (i.e., stacks, vents, doorways) associated with Mack. The odor sampling data includes:

- Source (e.g., stack) dimensions
- Odor concentration
- Air flow rate
- Temperature
- Source elevation

The baseline model, therefore, consisted of the following:

- Measured odor concentration and resulting emission rate data
- Five years of Representative Meteorological data recorded at Detroit City Airport
- Topography
- Physical dimensions of buildings and structures

- Receptors at the fence line extending 4 km from the facility

Selection of Odor Dispersion Modeling Target Result

FCA evaluated the appropriate target modeling output criteria.

State of Michigan Rule 336.1901 prohibits odor from causing an "(b) Unreasonable interference with the comfortable enjoyment of life and property." The State of Michigan utilizes a qualitative scale to evaluate whether an odor meets this threshold. An odor detected by an AQD inspector at a level three or higher on the State's Odor Scale is considered to be "detectable and objectionable" and is considered a violation of the State's nuisance odor regulations. The target established for the purposes of the FCA's evaluation of odor dispersion modeling is designed to conservatively protect against odors being detected on neighboring property at a level three or higher on the State's Odor Scale.

Detectable odor concentration is defined as the dilution which is required to reduce the odor intensity to the level at which only a specified percent of the human population, typically 50%, will detect the odor. This point represents the Detection Threshold, indicated as an Odor Unit (OU) of 1 (i.e., detectable with no dilution). With dispersion modeling, odor concentrations are expressed as an average over some specific time period, normally from 10 to 30 minutes. Ten-minute average odor concentrations are generally used to account for typical human response characteristics to a wide range of odorous materials. Michigan does not provide specific guidance on the allowable Odor Unit concentrations at the property line to achieve this.

Neither the State of Michigan, nor the US EPA has a written standard or guidance based on OUs. Therefore, FCA considered literature and other jurisdictions that specifically employ the OU scale when assessing odor. FCA identified the guidance set forth in Ontario Environmental Protection Act (EPA), Section 14 to be an appropriate and conservative approach to assessing odor. The most recent Ontario Ministry of the Environment, Conservation, and Parks (MOECC) guidance regarding odor impacts indicates that odor impacts above 1 OU at a sensitive receptor location are acceptable, as long as the frequency of occurrence is less than 0.5% of the time, based on a 5-year modelling period. Therefore, this level was used to analyze odor sources and select the appropriate mitigation actions and is considered to be a conservative approach to prevent the occurrence of a detectable and objectionable odor from reaching neighboring properties.

Odor Mitigation Strategies and Modeling Results

Based upon the results of the odor sampling program and incorporating that information into the input of the dispersion model, we were able to predict odor impacts associated

with certain point sources at the site. The source-specific evaluation was completed through a culpability analysis of the modeling results which indicates the contribution of each source to the maximum impacts on the receptor grid and the frequency with which the impacts occur.

The model was initially run using the odor inputs as determined through the odor testing. The results of that modeling run (referred to as the Baseline Condition) indicated that the frequency of occurrence of odor off site at a concentration greater than 1.0 OU was 7.3%. Note that this result represents the “worst case” odor emission footprint resulting from the odor emissions profile developed from the monitoring program and doesn’t necessarily correlate to actual observations. However, this approach provides a method to evaluate the potential improvement (e.g., reduction) in predicted odors resulting from the implementation of odor mitigation strategies.

Based on those results, and the culpability analysis of individual source contributions, the model inputs were adjusted to reflect reduced odor emissions which would result from the implementation of odor mitigation strategies at specific emission points. This was completed in an iterative manner until a control configuration was established that achieved the desired target of less than 0.5% of the off-site odor concentrations being greater than 1.0 OU. Table No. 1 provides the before (i.e., Baseline) and after (i.e., Mitigated) modeling inputs which represent the proposed mitigation actions to be implemented. The “Mitigated” model output resulted in a frequency of occurrence of odor off-site at a concentration greater than 1.0 OU which meets the established criteria of 0.5%. The odor control strategies included in the “Mitigated” model were then identified as the selected mitigation actions to be implemented at the site.

The identified Odor Mitigation Actions are as follows:

Odor Mitigation Actions

Source	Mitigation Action
Primer Ambient Flash	Route to existing Concentrator/RTO
Clearcoat Observation 1	Route to new RTO
Clearcoat Observation 2	Route to new RTO
Existing Concentrator	Route exhaust to stack of new RTO

Source	Mitigation Action
Sludge Tank	Alternative Technologies[1]
Prime Oven Cooling Tunnel	Alternative Technologies[1]
CC Oven Cooling Tunnel	Alternative Technologies[1]

1. Alternative Technologies will be implemented as appropriate for a given source. Potential alternative technologies include, but are not limited to, BioPolar Ionization, Odor Neutralization, Odor Chemical Oxidation.

It should be noted that improvements to certain production processes have been made which result in a decrease in odors emitted into the in-plant building air. As a result, odors from the building exhaust air are reduced. These potential odor sources related to building ventilation are recognized as having reduced odor concentrations and odor emission rates in our modeling analysis due to reduced indoor odor. These improvements have not been listed on the Mitigation Action table as they are a result of production process improvements, and do not require additional odor mitigation action or control.

3.0 Odor Mitigation Plan

As described above, FCA utilized the results of odor monitoring of emission sources and odor dispersion modeling to evaluate the effectiveness of potential odor mitigation strategies to reduce odors which can reach the neighboring properties. Based on those results, FCA has established the following Odor Mitigation Plan to be implemented at the facility.

Odor Mitigation Actions

Primer/Tutone Spraybooth Line

The exhaust from the primer and tutone ambient flash zones has been re-routed to the existing emissions abatement system. This work has been completed and is online. Odors from volatile organic compounds in the exhaust are reduced by thermal oxidation in this emission abatement system.

Clearcoat Observation Zones and Respective Flash Areas

A new dedicated regenerative thermal oxidizer (RTO) will be installed to destroy odor causing emissions that come from the two clearcoat observation and ambient flash zones. The exhaust from these two existing stacks will be routed to the new RTO for reduction of odor contributing compounds in the exhaust gasses.

Existing Concentrator Exhaust

The clean air exhaust from the existing concentrator will be routed to the stack of the new RTO to improve velocity and dispersion.

Primer and Topcoat Cooling Tunnels and Sludge Tank Exhaust

The primer paint cooling tunnel, topcoat paint cooling tunnel and the sludge tank exhaust have been identified as potential minor odor contributing sources. We have evaluated options for reduction of odors from these sources and are prepared to implement those technologies, as appropriate. Potential technologies include, but are not limited to, BioPolar Ionization, Odor Neutralization, Odor Chemical Oxidation.

FCA is proceeding with the engineering and procurement necessary to complete the work described in this Plan and is in discussion with EGLE regarding relevant permitting requirements related to the work. Timelines for completion will be driven, in part, by permitting requirements and deadlines imposed as part of the enforcement process.

Tables

Table No. 1 - DACM Paint Shop Odor Dispersion Modeling Inputs (Baseline and Post Mitigation)

Table No. 1 - DACM Paint Shop Odor Dispersion Modeling Inputs (Baseline and Post Mitigation)

Map ID	Exhaust Point	Baseline Dispersion Model Inputs [1]		Post Mitigation Dispersion Model Inputs		Mitigation Plan
		Odor Concentration (OU)	Odor Emission Rate (OU/s)	Odor Concentration (OU)	Odor Emission Rate (OU/s)	
1, 2	North Corridor - Exhaust Fan 08 & 09	53	75	35	50	General indoor odor improvement
3, 4	North Corridor Exhaust Fans (Ground Level)	53	75	35	50	General indoor odor improvement
5	Roof Exhaust 1	160	1,448	35	317	General indoor odor improvement
6	Roof Exhaust 2	38	869	35	801	General indoor odor improvement
7	Roof Exhaust 3	402	3,638	35	317	General indoor odor improvement
8	Roof Exhaust 4	40	860	35	753	General indoor odor improvement
9	Clearcoat Oven 1/2 Cooling Tunnel	128	3724	38	1117	Mitigation through alternative technology
10	Prime Oven 1/2 Cooling Tunnel	56	1871	17	561	Mitigation through alternative technology
11, 12	3rd Floor Wall Vents Northwest Wall	53	55	35	36	General indoor odor improvement
13	Phosphate Air Entrance	91	129	91	129	
14, 18	Exhaust Fan 10 & 1 (RTO) Ground Level	69	98	35	50	General indoor odor improvement
15	Phosphate 2B Exhaust	85	410	85	410	
16	RTO Outlet	110	4096	118	4395	Increased to include Primer Flash Exhaust
17	Rapid Reprocess	108	3500	45	1461	General indoor odor and make-up air improvement
19	Clearcoat 2 Observation	195	1727	See Map ID A		Routed to new RTO
20	Clearcoat 1 Observation	275	3278			Routed to new RTO
21	Concentrator Clean Air Exhaust	137	6207			Route exhaust to stack of new RTO
22	Sludge Tank Exhaust	240	1066	72	320	Mitigation through alternative technology
23	Side Wall Exhaust Elevator Shaft	49	503	35	359	General indoor odor improvement
24	Sludge Room Garage Door	60	1293	3	54	Maintaining closed door 98% of time
25	Roof Exhaust 5	38	344	35	317	General indoor odor improvement
26	Phosphate Stage 5	138	920	138	920	
27	E-Coat Stage 3 UF Dip	164	561	164	561	
28	Tutone Observation Exhaust	275	3974	138	1987	Routed primer ambient flash to existing concentrator
29	Basecoat 2 Observation	91	903	91	903	
30	Basecoat 1 Observation	120	1082	120	1082	
31	Roof Exhaust 6	46	280	35	213	General indoor odor improvement
32	E-Coat Oven 1/2 Cooling Tunnel	70	2,523	70	2,523	
33	52 Phosphate Stage 9	52	122	52	122	
34	Spot Prime Exhaust	56	916	56	916	
35	Roof Exhaust 7	216	1,955	35	317	General indoor odor improvement
A	New RTO (Exhaust from Clearcoat Obs and Flash)				7022	New control device (RTO) for Clearcoat Obs/Flash exhaust, plus concentrator exhaust to stack.

Notes:

1. Refer to the RWDI Report in Appendix A for the complete results of odor monitoring.

Figures

Figure No. 1 - DACM Paint Shop Odor Sampling Locations

Detroit Assembly Complex Mack – Paint Shop Odor Sampling Locations

1	North Corridor Exhaust Fan 08	8	Roof Fan 4	15	Phosphate 2B	22	Sludge Tank Exhaust	29	Color 2 Base Coat Observation
2	North Corridor Exhaust Fan 09	9	Clearcoat Oven 1&2 Cooling Tunnel	16	RTO	23	Side Wall Exhaust Elevator Shaft	30	Color 1 Base Coat Observation
3	North Exhaust Ground Level 2	10	Prime Oven 1&2 Cooling Tunnel	17	Rapid Reprocess	24	Sludge Room Garage Door	31	Roof Fan 6
4	North Exhaust Ground Level 1	11	3rd Floor Wall Vent NW 1	18	Side Wall Exhaust 10	25	Roof Fan 5	32	E-Coat Oven 1&2 Cooling Tunnel
5	Roof Fan 1	12	3rd Floor Wall Vent NW 2	19	Color 2 Clearcoat Observation	26	Phosphate Stage 5	33	Phosphate Stage 9
6	Roof Fan 2	13	Phosphate Air Seal Entrance	20	Color 1 Clearcoat Observation	27	E-coat Stage 3 UF Dip	34	Spot Prime
7	Roof Fan 3	14	Side Wall Exhaust 1	21	Booth Concentrator	28	Prime Observation	35	Roof Fan 7

Appendices

Appendix A - DACM Odor Sampling Program Report, RWDI, January 5, 2022

REPORT

FCA US LLC

DETROIT, MICHIGAN

DETROIT ASSEMBLY COMPLEX – MACK (DACM): ODOR SAMPING PROGRAM

RWDI # 2201188

January 5, 2022

SUBMITTED TO

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LIST OF APPENDICES

1 INTRODUCTION

RWDI AIR Inc. (RWDI) was retained by FCA US LLC (FCA) to conduct source sampling for the Detroit Assembly Complex – Mack (DACM) located at 4000 Saint Jean, Detroit, Michigan. Source testing for odor was completed to assist in the identification and quantification of potentially odorous sources of emissions at the DACM facility due to neighborhood concerns. The data provided in this report was utilized by other consultants to complete air dispersion modeling and to identify potential solutions to address the odor concern.

1.1 Project Description

152 odor samples were collected at various sources of potential emissions at the facility. The odor samples were taken on October 18th, 19th, 20th, 21st, 25th, November 4th, 9th, 10th, 16th, 18th, 19th, 22nd and 24th of 2021. The odor concentrations, hedonic tone (scale of how pleasant or unpleasant an odor is +10 is very pleasant and -10 is very unpleasant) as well as characteristics of the odors. For the odor concentrations, odor concentrations were provided as detectable concentration and recognition concentration. In general, detection concentrations are the dilution levels required to dilute the sample with odor free air until 50% of the odor panelists can confirm the odor is present in a sampling port and recognition concentrations are the dilution levels required to dilute the sample with odor free air until 50% of the odor panelists can identify and recognize the odor is present in a sampling port.

1.2 Objectives

This report outlines the results from the sampling program. As noted, the results were utilized by other consultants in order to determine the potential odors concentrations off-site as well as identification of mitigation recommendations for consideration.

2 ODOR SAMPLING PROGRAM

The following sections outlines the methodology taken to complete the odor measurements.

2.1 Odor Sampling Procedures

OSTC Method ON-6 “Determination of Odour Emissions from Stationary Sources” was utilized to collect all samples undiluted (neat) samples using an evacuated lung sampler, which contained a Teflon ® bag wherein the stack gas was drawn via a Teflon ® line. The bags were covered to avoid sunlight exposure and to minimize potential photochemical reactions. A blank samples were also submitted to the laboratory. Neat sampling techniques are used when source temperatures and moisture content are low and source odor concentration must be within the dilution range of the olfactometer.

A diagram of the neat odor sampling equipment set up is provided in **Figure 2.1.1**. The following equipment was utilized:

- Sample probe/line (clean Teflon, stainless-steel)
- Lung Chamber
- Sample bags (10L tedlar)
- Vacuum Pump

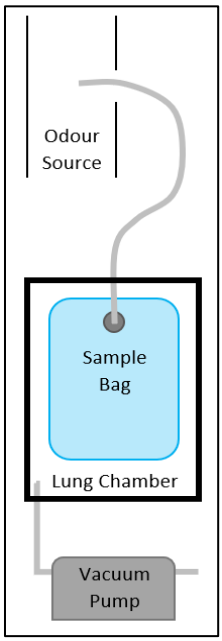


Figure 2.1.1: Lung Chamber (Undiluted) Sampling

Sample line is connected to the inlet of the lung chamber and inserted into the stack/duct. The sample line was located at a single point near the center of the stack/duct. All ports/openings were sealed to prevent dilution of the gas stream with ambient air. On field notes, the sample location, sample ID, time of sampling, date of sampling and comment regarding any field dilutions or moisture present in the sample bags are recorded.

A sample bag is connected to the sample line inside the lung chamber and seal the chamber. The sample bag is purged at least three (3) times by doing the following:

- Start vacuum pump;
- Allow bag to fill;
- Remove bag from lung chamber; and
- Empty all contents from bag.

After completing three (3) purges, a sample is collected. The vacuum pump flow rate is adjusted so that the sample is collected over a 5 to 10-minute period. Once the sample is collected, the sample bag is sealed, checked for leaks, and placed in opaque container (ex. black garbage bag) to avoid exposure to sunlight.

2.2 Odor Analysis Methodology

In order to handle the volume of odor samples, COVID-19 restrictions at the laboratories, and panel availability, three (3) laboratories were utilized. Odor samples were delivered to Pinchin Environmental, Environmental Odour Consulting Corporation and St. Croix Sensory, Inc. for odor panel analysis within 24 hours of collection. The laboratory analysis includes the determination of detection threshold for odor, and this value was used to calculate odor emission rates as outlined in the Reference Method. Analysis also included recognition levels, hedonic tone and characteristics .

The odor samples are presented to the panelists using the "triangular forced-choice" method, described by ASTM E679-19, "Standard Practice for Determination of Odour and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits". Each panelist evaluated the odor by "sniffing" the diluted odor samples presented by the Olfactometer. At each dilution level, the panelist "sniffed" three sample presentations, two of which were blank, odor free samples and one that contained the odorous air. The panelist was then asked to identify which of the three presentations was different from the other two by recording a "guess", "detect" or "recognize" response as defined by ASTM E679-19. A "guess" response was recorded when the assessor could not distinguish between any of the presentations. A "detect" response was recorded when the assessor could differentiate the odorous sample from the two blanks, and "recognize" was recorded when the assessor could identify and describe the odorous sample.

As per BS EN 13725:2003, each sample assessment began with the Olfactometer diluting the odorous sample to sub-detection levels. The odor sample and two blanks were then presented to one panelist, who "sniffed" the three presentations and recorded their response. The concentration of odorous gas was then doubled and re-presented to the same assessor with two blanks. Again, the assessor "sniffed" the three presentations and recorded their response. The process continued with the concentration of odorous gas increasing until the panelist had correctly detected the odor in at least two consecutive presentations as described by BS EN 13725:2003. The process was repeated for each panelist until all samples were evaluated.

Sample analysis was conducted "blind"; neither the panelist nor the test administrator knew which port would deliver the odor sample. Panelist's results were recorded and analyzed using with the Olfactometer.

The odor reports includes the following information:

- The panel(s) odor threshold and the unique numerical or alphanumerical ID of each of the odor evaluators.
- Any odor evaluator excluded during this program, due to odor sensitivity concerns, shall be identified (using the unique numerical or alphanumerical ID) in the odor evaluation report.
- Arrival condition of the samples at the lab.
- All the dilution presentation steps of the odor and blank samples for each of the odor evaluators.

2.3 Odor Evaluation Parameters

For the following sections, excerpts were collected from the methodologies of the laboratories. Each laboratory may have slight modifications to the exact procedures, however, in general, the following methodologies were followed by each respective laboratory.

2.3.1 Odor Threshold Values – Detection Threshold (DT)

The detection threshold (DT) is the dilution ratio at which 50% of the panelists correctly detected the odor. DT, as defined by ASTM E679-19, is synonymous and the BS EN 13725:2003 definition of odor concentration (COD). That is, the DT represents the amount of dilution required for the odor to be just detectable. Since DT values are dimensionless, pseudo-dimensions of odor units per unit volume (i.e. odor units per cubic meter (OU/m^3)) are often used for reporting purposes.

In accordance with BS EN 13725:2003, individual threshold estimates (ZITE) were calculated as the geometric mean of the lowest dilution ratio where the odor could not be detected and the dilution ratio at which the panelist correctly detected the odor. Where a detection response could not be established at the Olfactometer's dilution limit, it was assumed that the panelist would have detected the odor at a dilution ratio half that of the limit, and the ZITE was calculated. The sample odor concentration (COD) was then calculated as the geometric mean of the ZITE values.

2.3.2 Odor Threshold Values – Recognition Threshold (RT)

The recognition threshold (RT), as defined by ASTM E679-19 is the dilution ratio at which the assessor first detects the odor's character (i.e. the odor "smells like…") or the dilution level at which 50% of the panelists correctly recognized the odor. RT was evaluated following the same procedure as outlined for DT except once the assessor correctly detected the odor, the process continued with the concentration of odorous gas increasing until the panelist had correctly recognized the odor in at least two consecutive presentations. The process was repeated for each panelist until all samples were evaluated. Calculations for RT were based on the BS EN 13725:2003 procedures for the determination of odor concentration (COD) where the individual recognition threshold estimates were calculated as the geometric mean of the lowest dilution ratio where the odor could not be recognized and the dilution ratio at which the panelist correctly recognized the odor. Where a recognition response could not be established at the Olfactometer's dilution limit, it was assumed that the panelist would have recognized the odor at a dilution ratio half that of the limit, and the individual recognition threshold estimate was calculated. The sample RT was then calculated as the geometric mean of the individual recognition threshold estimates.

2.3.3 Hedonic Tone (HT)

Hedonic tone (HT) is a measure of the pleasantness or unpleasantness of an odor sample and is independent of its character. Odors are commonly ranked by hedonic tone using the following 21 point scale:

- +10 Most Pleasant
- 0 Neutral
- -10 Least Pleasant

Prior to evaluating a sample for HT, each panelist was provided with a copy of an odor descriptor data collection form. For each sample requiring HT, the recognition threshold (RT) was determined by following the procedures outlined above. Once the panelist had correctly recognized the odor in two consecutive responses, the panelist was asked to mark the box corresponding to the point on the 21 point scale which best described the "pleasantness" of the odor. HT evaluation is done independently by each panelist without the consultation of the other panel members or the test administrator. The average of the individual HT values was reported as the HT for the sample. If the panelist was unable to recognize the odor at the Olfactometer's dilution limit, that panelist was eliminated from the calculation of the sample HT.

2.3.4 Odor Character

There are numerous odor wheels available for use as a referencing vocabulary when describing an odor's character. The eight recognized odor categories include "Vegetable", "Fruity", "Floral", "Medicinal", "Chemical", "Fishy", "Offensive" and "Earthy". Each of the eight odor categories includes a list of specific descriptors to be used for further odor character analysis. The odor wheel currently used as Pinchin is shown in the figure below.

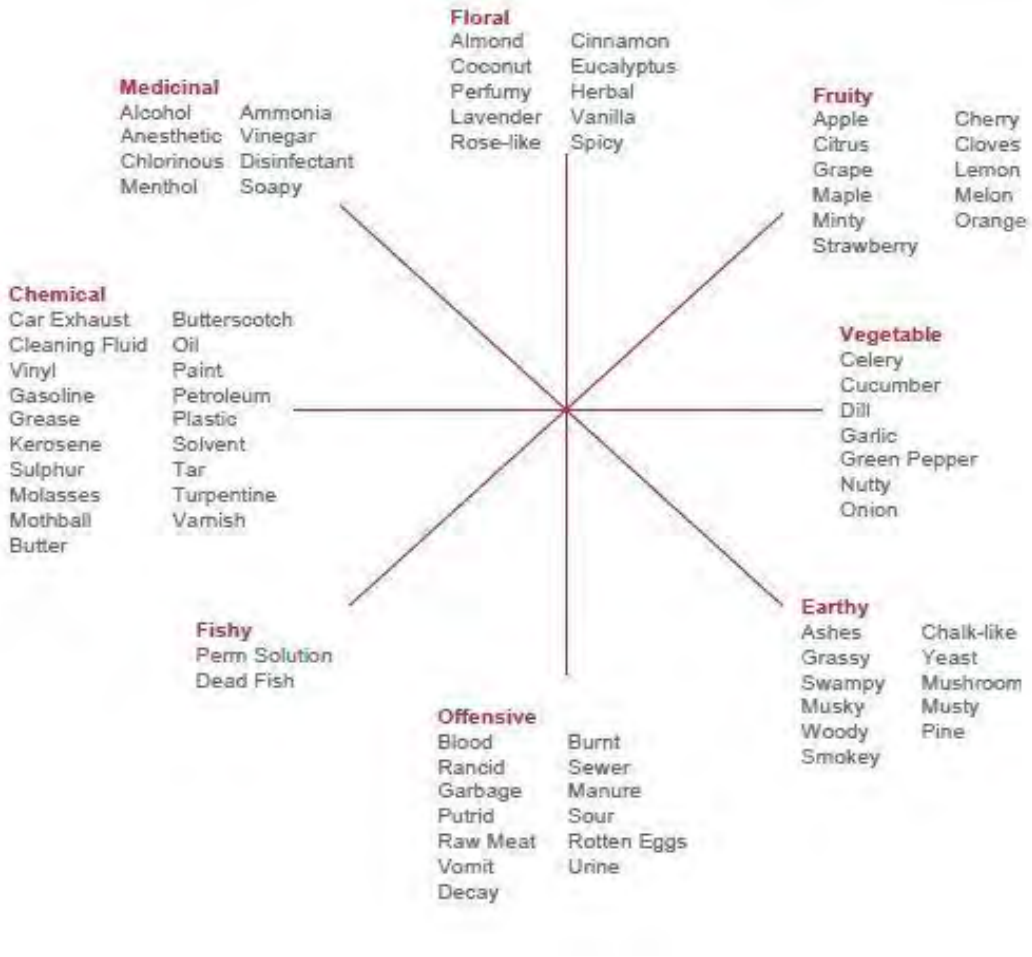


Figure 2.3.4.1: Odor Character Reference Vocabulary Wheel

Prior to evaluating a sample for odor character, each panelist was provided with a copy of an odor descriptor data collection form. For each sample requiring characterization, the recognition threshold (RT) was determined by following the procedures outlined above. If a panelist was unable to recognize the odor at the Olfactometer's dilution limit, that panelist was eliminated from odor character evaluations. Once the panelist had correctly recognized the odor in two consecutive responses, the panelist was asked to indicate which of the eight general odor categories best described the odor. In addition, the assessor was asked to mark the box corresponding to the strength of the odor within that general category. The odor strength is referred to as the relative odor intensity. The relative odor intensity was determined using a 5 point scale. The number "1" corresponds to a mild odor and "5" corresponds to a strong odor. Assessors were given the option to choose as many general categories as required to describe the odor. The eight general odor categories were presented on a spider graph with each extension representing a scale of 0 to 5, referencing relative intensity (mild to strong). The intensity is the average of the individual intensity scores reported for that category. General odor categories showing a "0" were not used by the panelists in the odor's general character description.

Once the general odor character section was complete, the assessors were asked to indicate specific odor descriptors. Assessors were given the option to choose as many specific descriptors as required to describe the odor and to add their own descriptions as required. A histogram was used to present the percentage of assessors that assigned specific descriptors to the odor sample.

All odor character evaluation is done independently by each panelist without the consultation of the remainder of the panel or the test administrator

2.4 Stack Velocity, Temperature, and Volumetric Flow Rate Determination

The exhaust velocities and flow rates were determined following the US EPA Method 1 & 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and digital manometer. Volumetric flow rates were determined following the equal area method as outlined in US EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type-k thermocouple in conjunction with a digital temperature indicator.

Stack gas composition was confirmed using a Fyrite. Moisture was determined either based on historical source testing data or wet/dry bulb techniques. Many of the sources were samples more than once during the program. The flow rate determination was completed once during the survey and data was used for estimating odor emission rates for the remainder of the samples collected.

2.5 Quality Assurance/Quality Control Activities

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measures included detailed documentation of field data, equipment calibrations for all measured parameters, completion of Chain of Custody forms when submitting laboratory samples, and submission of field blank samples to the laboratories. All samplers were bench tested and calibrated in RWDI's office prior to field deployment. Chain of custody forms were completed and submitted along with the samples to the laboratory.

Records of the laboratory reports, equipment calibrations and field notes are all contained electronically.

3 OPERATING CONDITIONS

Operating conditions during the sampling were monitored by DACM personnel. Production rates during testing events are provided in is provided in **Appendix A, Table A1a**.

4 ODOR SAMPLING RESULTS

A total of forty-two (42) sources were evaluated for odor potential. Results are provided in **Appendix A**. Information in **Appendix A** contains the following information for each of the sources:

- Sample identification;
- Sample date;
- Time sample was collected;
- Paint Shop Production Data (Daily);
- Hourly Production Rate during test time;
- Odor concentration;
- Odor emission rate;
- Odor characteristic; and
- Hedonic tone.

The following table summarizes the sources and number of samples collected from each source during the program.

Source	No. of Samples	Source	No. of Samples	Source	No. of Samples
Clearcoat 2 Observation Stack	7	**Clearcoat 1 Observation Stack**	11	**Concentrator Clean Air Stack**	7
Rapid Repair	6	**Sludge Tank Exhaust Stack**	6	**Desorb Purge Air Exhaust**	4
Tutone Observation Stack	4	**Basecoat 1 Observation Stack**	4	**Basecoat 2 Observation Stack**	6
Spot Prime Exhaust Stack	4	**Phosphate Stage 2B Exhaust**	6	**Prime Oven 1 & 2 Cooling Tunnel Exhaust**	6
Clearcoat Oven 1 & 2 Cooling Tunnel	6	**Phosphate Air Entrance Exhaust**	4	**3rd Floor Wall Vent Northwest Wall #1**	4
3rd Floor Wall Vent Northwest Wall #2	4	**Roof Exhaust #2**	2	**Roof Exhaust #4**	2
E-Coat Oven 1 & 2 Cooling Tunnel Exhaust	6	**Phosphate Stage 5 Exhaust**	6	**Roof Exhaust #5**	4
Roof Exhaust #6	3	**Phosphate Stage 9 Exhaust**	6	**E-Coat Stage 3 UF Dip**	4
E-Coat Stage 1 Bypass Exhaust	2	**1st Floor Side Wall Vent N6**	2	**Sludge Room Garage Door**	2
North Corridor Side Wall Vent 8	1	**North Corridor Side Wall Vent 9**	1	**RTO Outlet**	6
Side Wall Vent 1 RTO/Elevator	1	**Side Wall Vent 10 RTO/Elevator**	1	**Roof Exhaust #7**	2
Roof Exhaust #3	2	**Roof Exhaust #1**	2	**Clearcoat 1 Oven Purge Exhaust**	1
Clearcoat 2 Oven Purge Exhaust	1	**Prime 1 Oven Purge Exhaust**	1	**Prime 2 Oven Purge Exhaust**	1
E-Coat 1 Oven Purge Exhaust	1	**E-Coat 2 Oven Purge Exhaust**	1	**North Exhaust 1st Floor**	2

5 CONCLUSIONS AND RECOMMENDATIONS

A summary of the results of the odor samples collected are provided within the report and Appendices. Information collected at the site was utilized by FCA and their consultants in order to complete further evaluations and to assist in the identification of odor reduction strategies.

FIGURES

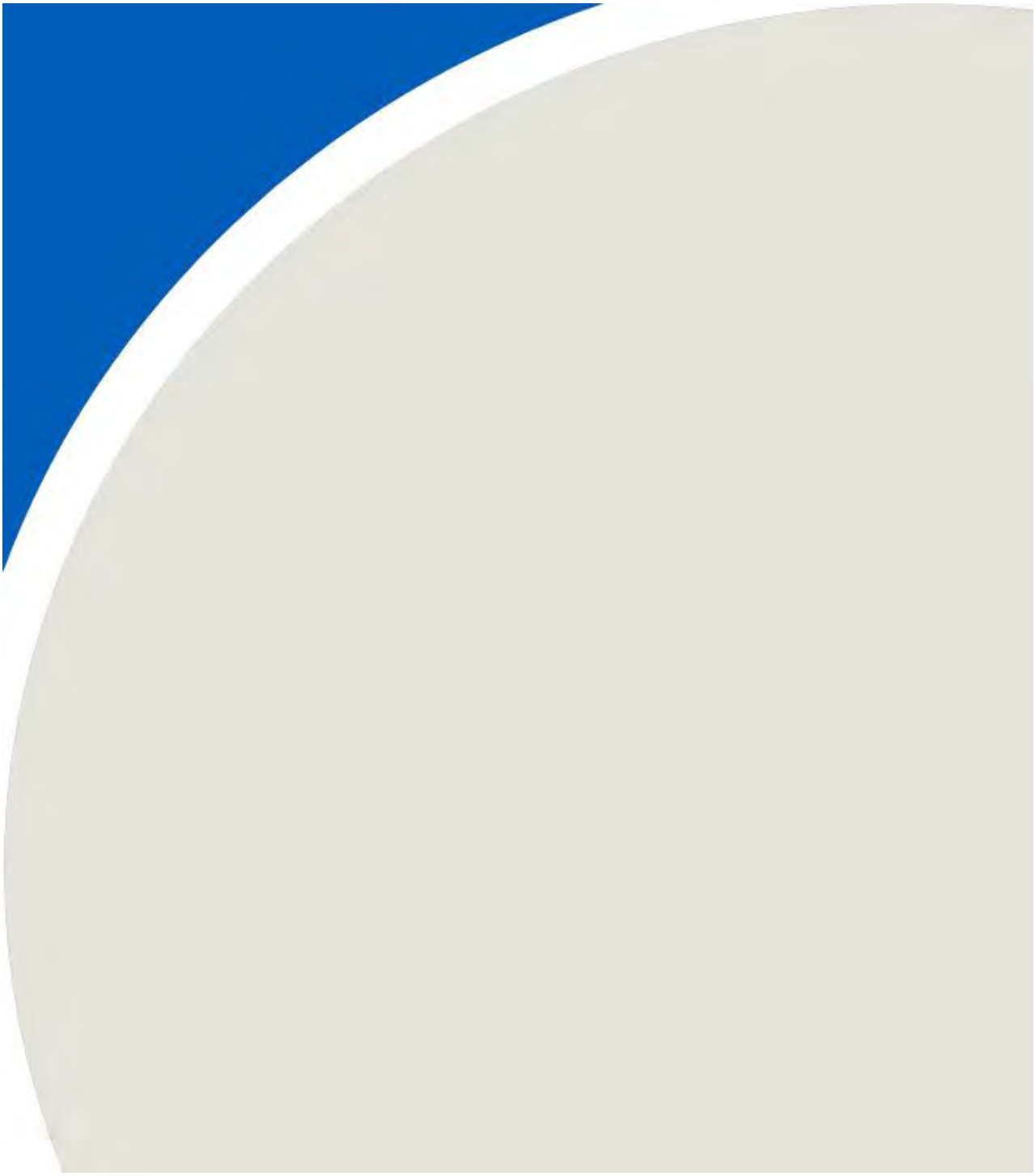


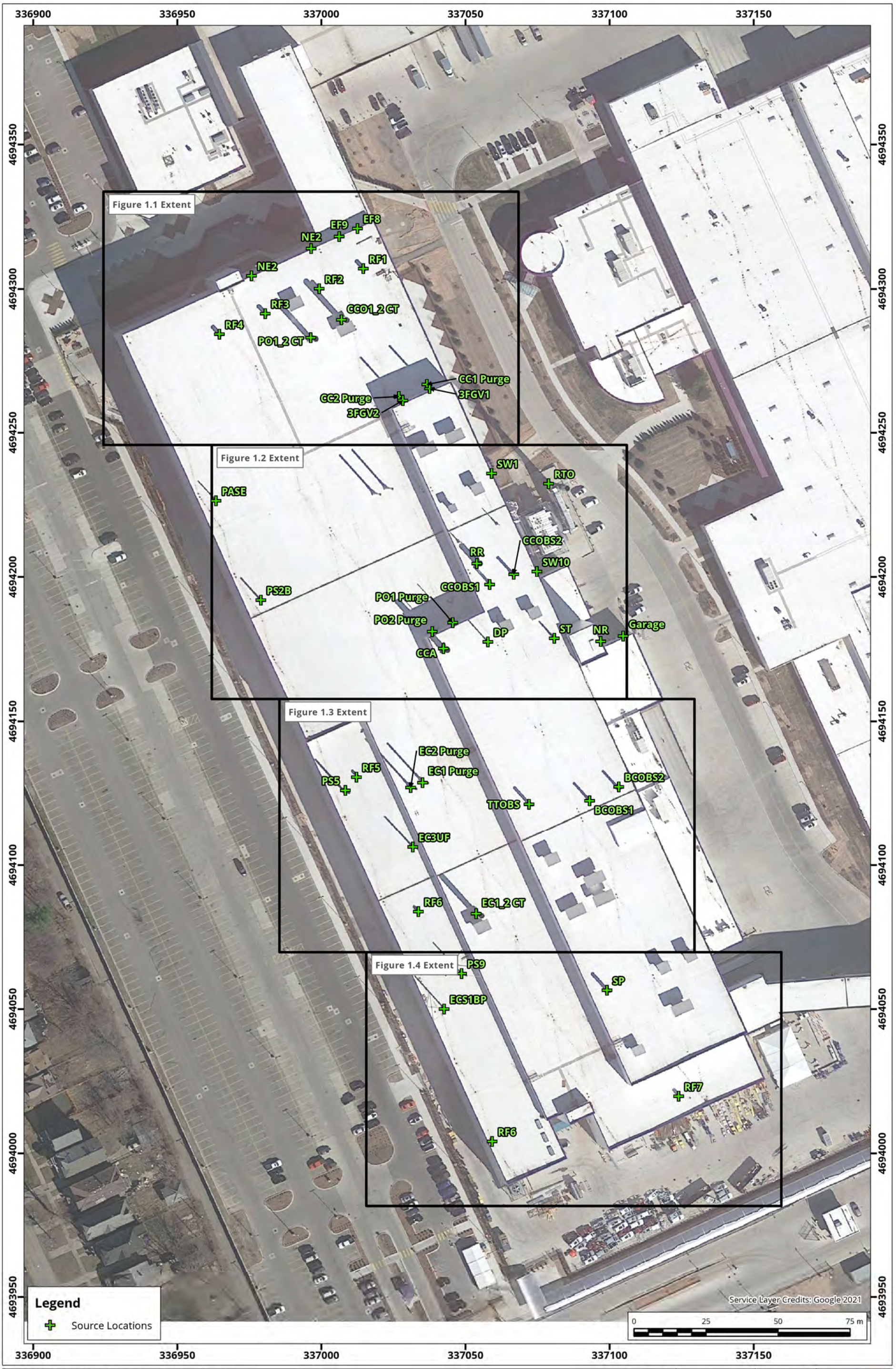
Figure Legend

Figure Identifier	Source Name	Figure Reference
EF8	Side Wall Vent North Wall 1st Floor	Figure 1.1
EF9	Side Wall Vent North Wall 1st Floor	Figure 1.1
NE1	Side Wall Vent North Wall 1st Floor	Figure 1.1
NE2	Side Wall Vent North Wall 1st Floor	Figure 1.1
RF1	Roof Exhaust 1	Figure 1.1
RF2	Roof Exhaust 2	Figure 1.1
RF3	Roof Exhaust 3	Figure 1.1
RF4	Roof Exhaust 4	Figure 1.1
CCO1_2 CT	Clearcoat Oven 1&2 Cooling Tunnel	Figure 1.1
PO1_2 CT	Prime Oven 1&2 Cooling Tunnel	Figure 1.1
CC1 Purge	Clearcoat Oven 1 Purge	Figure 1.1
CC2 Purge	Clearcoat Oven 2 Purge	Figure 1.1
3FGV1	3rd Floor General Ventilation Side Wall Vent	Figure 1.1
3FGV2	3rd Floor General Ventilation Side Wall Vent	Figure 1.1

Figure Identifier	Source Name	Figure Reference
PASE	Phosphate Air Seal Entrance	Figure 1.2
PS2B	Phosphate Stage 2B	Figure 1.2
PO1 Purge	Prime Oven 1 Purge	Figure 1.2
PO2 Purge	Prime Oven 2 Purge	Figure 1.2
CCA	Concentrator Clean Air Exhaust	Figure 1.2
DP	Desorb Purge	Figure 1.2
ST	Sludge Tank Exhaust	Figure 1.2
NR	Side wall vent 1st Floor	Figure 1.2
Garage	Sludge Building Garage Door	Figure 1.2
SW1	1st Floor Side Wall Vent	Figure 1.2
SW10	1st Floor Side Wall Vent	Figure 1.2
CCOBS1	Clearcoat 1 Observation Exhaust	Figure 1.2
CCOBS2	Clearcoat 2 Observation Exhaust	Figure 1.2
RR	Rapid Repair Exhaust	Figure 1.2
RTO	RTO Exhaust	Figure 1.2

Figure Identifier	Source Name	Figure Reference
RF5	Roof Exhaust 5	Figure 1.3
PS5	Phosphate Stage 5	Figure 1.3
EC1 Purge	E-Coat Oven 1 Purge	Figure 1.3
EC2 Purge	E-Coat Oven 2 Purge	Figure 1.3
EC3UF	E-Coat Stage 3 UF Dip	Figure 1.3
RF6	Roof Exhaust 6	Figure 1.3
EC1_2 CT	E-Coat Oven 1&2 Cooling Tunnel	Figure 1.3
PS9	Phosphate Stage 9	Figure 1.3
TTOBS	Tutone Observation Exhaust	Figure 1.3
BCOSB1	Basecoat 1 Observation	Figure 1.3
BCOBS2	Basecoat 2 Obsevation	Figure 1.3

Figure Identifier	Source Name	Figure Reference
PS9	Phosphate Stage 9	Figure 1.4
ECS1BP	E-Coat Stage 1 Bypass	Figure 1.4
RF6	Roof Exhaust 6	Figure 1.4
SP	Spot Prime Exhaust	Figure 1.4
RF7	Roof Exhaust 7	Figure 1.4



Odor Testing Source Locations

True North

Drawn by: DJH | Figure: 1

Approx. Scale: 1:1,250

Date Revised: Jan 5, 2022

Map Projection: NAD 1983 UTM Zone 17N

FCA US LLC Detroit Assembly Complex - Mack - Paint Shop - Detroit, MI

Project #: 2201188

Odor Testing Source Locations

True North

Drawn by: DJH	Figure: 1.1
Approx. Scale: 1:700	
Date Revised: Dec 23, 2021	

Map Projection: NAD 1983 UTM Zone 17N

FCA US LLC Detroit Assembly Complex - Mack - Paint Shop - Detroit, MI

Project #: 2201188

Map Document: C:\GIS Temp - Copy\2201188\P2201188_4000_S(lean.aprx

Odor Testing Source Locations

True North

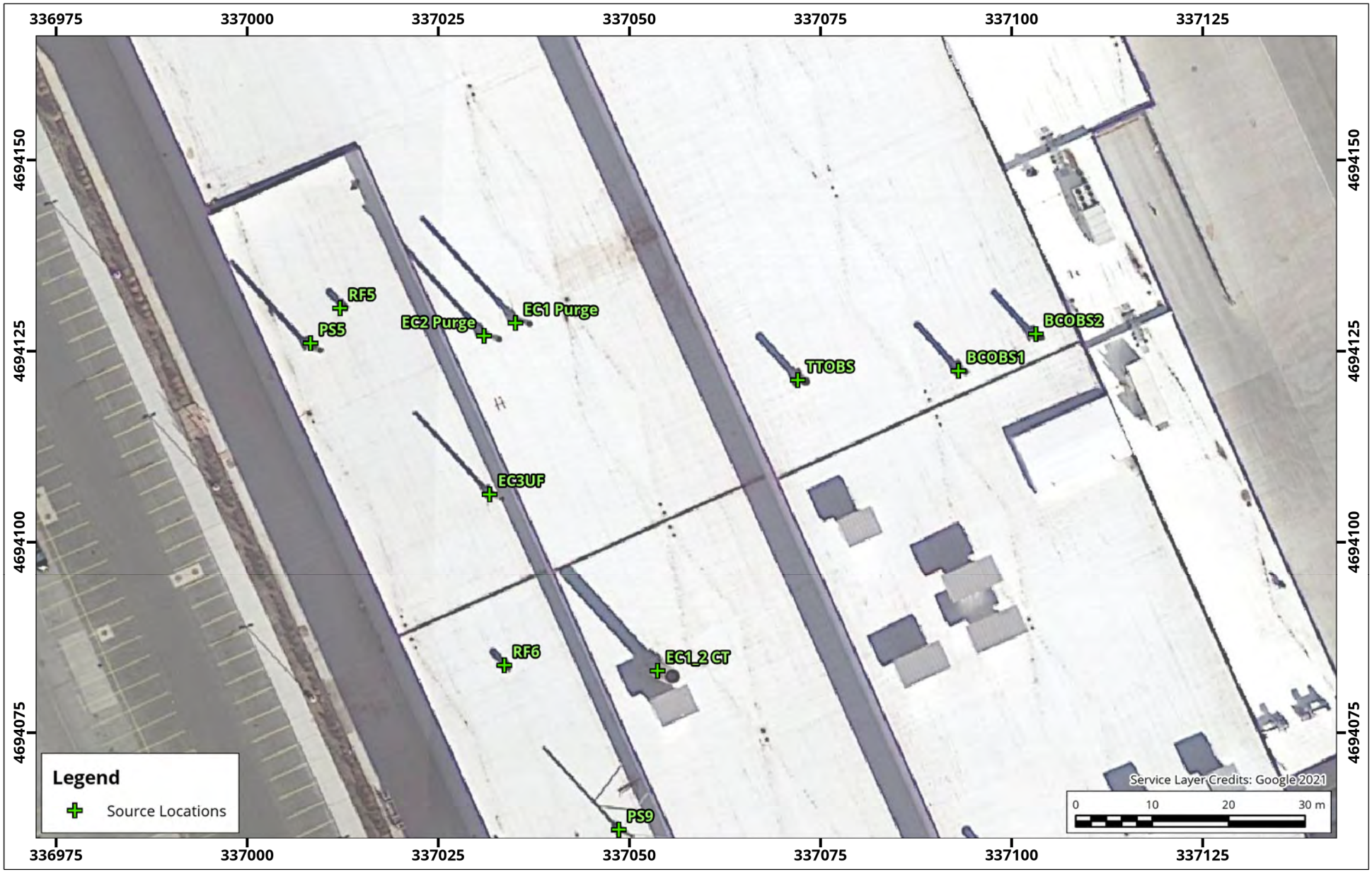
Drawn by: DJH	Figure: 1.2
Approx. Scale: 1:700	
Date Revised: Dec 23, 2021	

Map Projection: NAD 1983 UTM Zone 17N

FCA US LLC Detroit Assembly Complex - Mack - Paint Shop - Detroit, MI

Project #: 2201188

Map Document: C:\GIS Temp - Copy\2201188\P2201188_4000_SIplan.aprx



Odor Testing Source Locations

True North

Drawn by: DJH	Figure: 1.3
Approx. Scale:	1:700
Date Revised:	Jan 5, 2022

Map Projection: NAD 1983 UTM Zone 17N

FCA US LLC Detroit Assembly Complex - Mack - Paint Shop - Detroit, MI

Project #: 2201188

Map Document: C:\GIS Temp - Copy\2201188\P2201188_4000_Sjean.aprx

Odor Testing Source Locations

True North

Drawn by: DJH	Figure: 1.4
Approx. Scale: 1:700	
Date Revised: Dec 23, 2021	

Map Projection: NAD 1983 UTM Zone 17N

FCA US LLC Detroit Assembly Complex - Mack - Paint Shop - Detroit, MI

Project #: 2201188

Map Document: C:\GIS Temp - Copy\2201188\P2201188_4000_S(lean.aprx

APPENDIX A: ODOR MEASUREMENT RESULTS

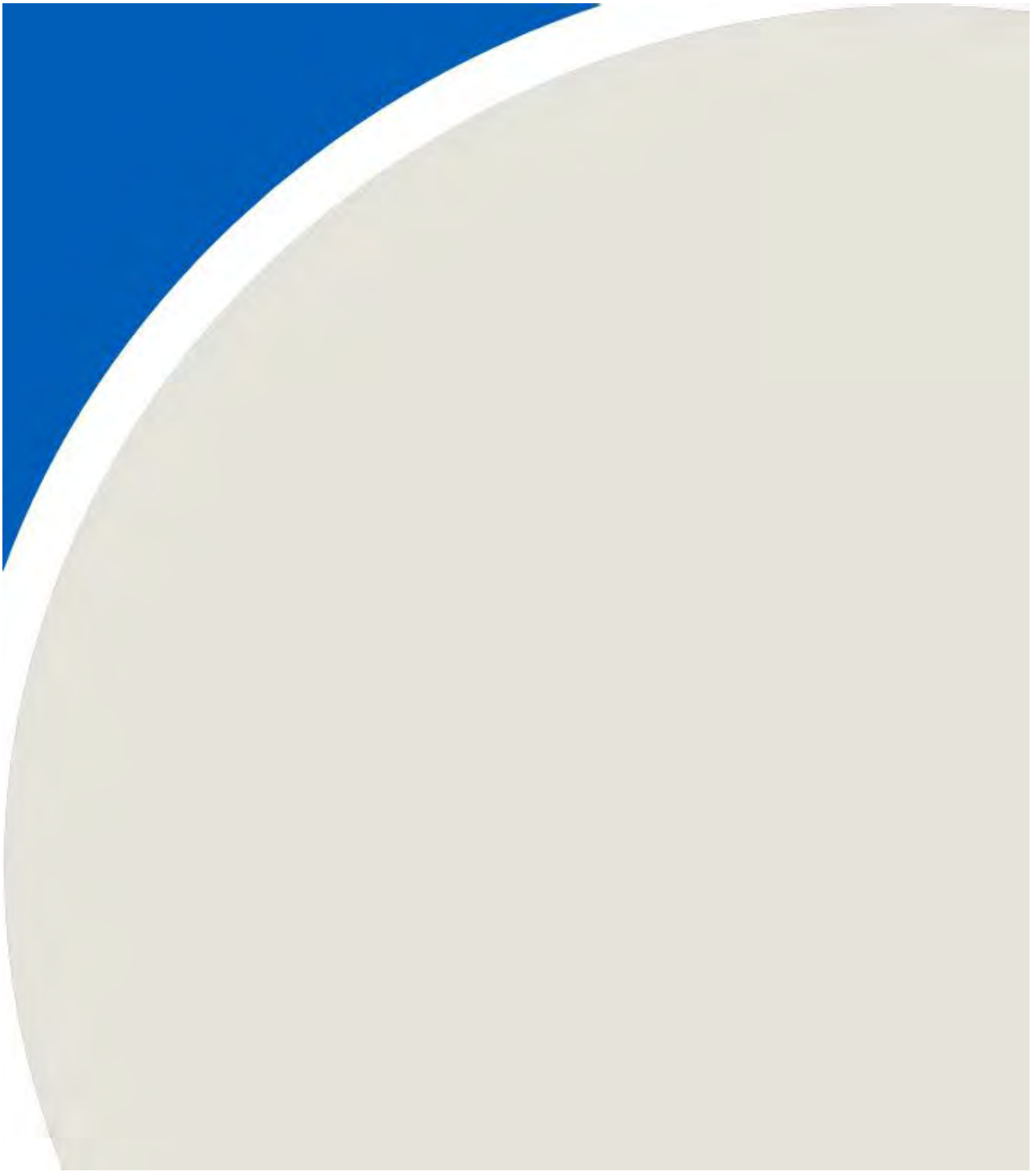


Table A1a: Odor Concentration, Emission Rates, and Production Rate Records

Round	Sample	ID	Sample Date	Time of Day	Paint Shop Production (total for day)	Hourly/Shift Production Previous hour from sample time	Odor Concentration (OU)	Average OU for same day sample	Odor Emission Rate (OU/s)
1	Clearcoat 2 Observation	CC2-T1	18-Oct-21	12:42	791	29	364	280	3979
		CC2-T2	18-Oct-21	13:00	791	22	195		2131
2		CC2-T1	9-Nov-21	13:00	856	9	158	148	1,727
		CC2-T2	9-Nov-21	13:15	856	9	138		1,508
3		CC2-T1	19-Nov-21	9:19	842	8	290	290	3,170
4		CC2-T2	22-Nov-21	11:45	838	12	520	570	5,684
		CC2-T1	22-Nov-21	11:56	838	13	620		6,777
					Average:	**Previous hour from sample time**	***326***	**--**	***3568***
1	Clearcoat 1 Observation	CC1-T1	18-Oct-21	12:39	791	26	275	242	3278
		CC1-T2	18-Oct-21	12:53	791	27	209		2491
2		CC1-T1	9-Nov-21	12:32	856	17	128	133	1,526
		CC1-T2	9-Nov-21	12:40	856	15	138		1,645
3		CC1-T1	16-Nov-21	11:36	745	16	720	505	8,582
		CC1-T2	16-Nov-21	11:38	745	16	290		3,457
4		CC1-T1	18-Nov-21	16:06	675	10	170	190	2,026
		CC1-T2	18-Nov-21	16:16	675	11	210		2,503
5		CC1-T1	19-Nov-21	9:49	842	30	440	440	5,245
6		CC1-T1	22-Nov-21	11:16	838	6	240	340	2,861
		CC1-T2	22-Nov-21	11:22	838	7	440		5,245
					Average:	***Sum of all spraybooths***	***296***	**--**	***3533***
1	Concentrator Clean Air Exhaust	CCA-T1	18-Oct-21	13:24	791	114	137	81	6207
		CCA-T2	18-Oct-21	13:36	791	98	24		1087
2		CCA-T1	25-Oct-21	10:00	90	108	74	80	3353
		CCA-T2	25-Oct-21	10:10	90	91	85		3851
3		CCA-T1	9-Nov-21	12:04	856	118	79	82	3579
		CCA-T2	9-Nov-21	12:12	856	115	85		3851
4		CCA-T1	19-Nov-21	11:05	842	122	260	260	11781
					Average:	***Shift Total***	***106***	**--**	***4816***
1	Rapid Repair	RR-T1	18-Oct-21	13:30	791	7	64	57	2077
		RR-T2	18-Oct-21	13:44	791	7	49		1591
2		RR-T1	9-Nov-21	12:40	856	9	104	108	3,376
		RR-T2	9-Nov-21	12:36	856	9	112		3,636
3		RR-T1	22-Nov-21	11:02	838	10	159	159	5,161
		RR-T2	22-Nov-21	11:08	838	10	159		5,161
					Average:	***N/A***	***108***	**--**	***3500***
1	Sludge Tank Exhaust	Sludge Tank T1	18-Oct-21	14:25	791	N/A	195	218	866
		Sludge Tank T2	18-Oct-21	14:36	791	N/A	240		1066
2		Sludge Tank T1	4-Nov-21	11:20	613	N/A	419	468	1,860
		Sludge Tank T2	4-Nov-21	11:25	613	N/A	516		2,291
3		Sludge Tank T1	22-Nov-21	10:48	838	N/A	297	331	1,319
		Sludge Tank T2	22-Nov-21	10:56	838	N/A	365		1,621
					Average:	***N/A***	***339***	**--**	***1504***
1	Desorb Purge Exhaust	Desorb Purge T1	18-Oct-21	14:24	791	N/A	480	435	72
		Desorb Purge T2	18-Oct-21	14:38	791	N/A	389		58
2		Desorb Purge T1	22-Nov-21	10:50	838	N/A	341	353	51
		Desorb Purge T2	22-Nov-21	10:55	838	N/A	365		55
					Average:	***Prime & Tutone previous hour***	***394***	**--**	***59***
1	Tutone Observation Exhaust	Tutone T1	18-Oct-21	15:09	791	44	275	242	3974
		Tutone T2	18-Oct-21	15:25	791	49	209		3020
2		Tutone T1	9-Nov-21	11:05	856	22	158	148	2,283
		Tutone T2	9-Nov-21	11:11	856	20	138		1,994
					Average:	***Previous hour from sample time***	***195***	**--**	***2818***

Table A1a: Odor Concentration, Emission Rates, and Production Rate Records

Round	Sample	ID	Sample Date	Time of Day	Paint Shop Production (total for day)	Hourly/Shift Production Previous hour from sample time	Odor Concentration (OU)	Average OU for same day sample	Odor Emission Rate (OU/s)
1	Basecoat 1 Observation	BC1-T1	19-Oct-21	11:54	705	21	120	102	1082
		BC1-T2	19-Oct-21	12:07	705	20	84		758
2		BC1-T1	9-Nov-21	11:20	856	22	104	108	938
		BC1-T2	9-Nov-21	11:30	856	24	112		1,010
						Average:	***Previous hour from sample time***	***105***	--	***947***
1	Basecoat 2 Observation	BC2-T1	19-Oct-21	11:54	705	20	91	74	903
		BC2-T2	19-Oct-21	12:09	705	21	56		556
2		BC2-T3	25-Oct-21	10:20	90	15	69	52	684
		BC2-T4	25-Oct-21	10:30	90	10	35		347
3		BC2-T1	9-Nov-21	11:36	856	20	64	56	635
		BC2-T2	9-Nov-21	11:48	856	19	48		476
						Average:	***N/A***	***61***	--	***600***
1	Spot Prime Exhaust	SPRIME T1	19-Oct-21	12:30	705	N/A	56	56	916
		SPRIME T2	19-Oct-21	12:36	705	N/A	56		916
2		SPRIME T1	9-Nov-21	10:26	856	N/A	37	45	605
		SPRIME T2	9-Nov-21	10:45	856	N/A	52		851
						Average:	***Production hr (13:00-14:00)***	***50***	--	***822***
1	Phosphate 2B Exhaust	Phosphate 2B - T1	19-Oct-21	13:20	705	47	49	59	236
		Phosphate 2B - T2	19-Oct-21	13:45	705	47	69		333
2		Phosphate 2B - T3	25-Oct-21	10:44	90	0	85	73	410
		Phosphate 2B - T4	25-Oct-21	10:52	90	0	60		289
3		Phosphate 2B - T1	10-Nov-21	13:05	833	35	411	405	1981
		Phosphate 2B - T2	10-Nov-21	13:15	833	35	398		1918
						Average:	***Oven production hr (14:00-15:00)***	***179***	--	***861***
1	Prime Oven 1/2 Cooling Tunnel	Prime Oven 1/2 CT T1	19-Oct-21	14:32	705	23	56	51	1871
		Prime Oven 1/2 CT T2	19-Oct-21	14:42	705	23	45		1503
2		Prime Oven 1/2 CT T1	10-Nov-21	11:56	833	23	185	193	6,181
		Prime Oven 1/2 CT T2	10-Nov-21	11:59	833	23	201		6,715
3		Prime Oven 1/2 CT T1	22-Nov-21	13:23	838	31	45	45	1503
		Prime Oven 1/2 CT T2	22-Nov-21	13:36	838	31	45		1503
						Average:	***Oven production hr (14:00-15:00)***	***96***		***3213***
1	Clearcoat Oven 1/2 Cooling Tunnel	CC 1/2 CT T1	19-Oct-21	14:28	705	40	128	124	3724
		CC 1/2 CT T2	19-Oct-21	14:39	705	40	120		3491
2		CC 1/2 CT T1	10-Nov-21	12:10	833	30	271	288	7,883
		CC 1/2 CT T2	10-Nov-21	12:20	833	30	304		8,843
3		CC 1/2 CT T1	22-Nov-21	13:28	838	21	45	45	1309
		CC 1/2 CT T2	22-Nov-21	13:42	838	21	45		1309
						Average:	***Production hr (13:00-14:00)***	***152***		***4427***
1	Phosphate Air Entrance	Phosphate ACE T1	19-Oct-21	13:55	705	47	84	88	119
		Phosphate ACE T2	19-Oct-21	14:03	705	47	91		129
2		Phosphate ACE T1	10-Nov-21	13:20	833	35	469	416	666
		Phosphate ACE T2	10-Nov-21	13:28	833	35	362		514
						Average:	***N/A***	***252***		***357***
1	3rd Floor Wall Vent Northwest Wall	3F NWT1	20-Oct-21	11:20	614	N/A	53	50	55
		3F NWT2	20-Oct-21	11:25	614	N/A	46		47
2		3F NWT1	10-Nov-21	9:45	833	N/A	158	183	163
		3F NWT2	10-Nov-21	9:50	833	N/A	208		214
1	3rd Floor Wall Vent Northwest Wall	3F NWT3	20-Oct-21	11:36	614	N/A	50	47	52
		3F NWT4	20-Oct-21	11:41	614	N/A	43		44
2		3F NWT3	10-Nov-21	9:55	833	N/A	124	136	128
		3F NWT4	10-Nov-21	10:00	833	N/A	147		151
						Average:	***N/A***	***104***		***107***

Table A1a: Odor Concentration, Emission Rates, and Production Rate Records

Round	Sample	ID	Sample Date	Time of Day	Paint Shop Production (total for day)	Hourly/Shift Production Previous hour from sample time	Odor Concentration (OU)	Average OU for same day sample	Odor Emission Rate (OU/s)
1	Roof Exhaust 2	RF2-T1	20-Oct-21	11:57	614	N/A	31	35	709
		RF2-T2	20-Oct-21	12:10	614	N/A	38		869
2		RF2-T1	10-Nov-21	10:58	833	N/A	371	339	8,488
		RF2-T2	10-Nov-21	11:06	833	N/A	306		7,001
3		RF2-T1	24-Nov-21	10:39	728	N/A	277	184	6,338
		RF2-T2	24-Nov-21	10:46	728	N/A	91		2,082
					Average:	***N/A***	***186***	**--**	***4248***
1	Roof Exhaust 4	RF4-T1	20-Oct-21	11:58	614	N/A	40	38	860
		RF4-T2	20-Oct-21	12:40	614	N/A	35		753
2		RF4-T1	10-Nov-21	11:26	833	N/A	234	348	5,033
		RF4-T2	10-Nov-21	11:30	833	N/A	462		9,938
3		RF4-T1	24-Nov-21	10:35	728	N/A	91	125	1,957
		RF4-T2	24-Nov-21	10:45	728	N/A	158		3,399
					Average:	***Oven production hr (12:00-13:00)***	***170***	**--**	***3657***
1	E-Coat Oven 1/2 Cooling Tunnel	E-Coat 1/2 CT-T1	20-Oct-21	12:40	614	18	70	66	2,523
		E-Coat 1/2 CT-T2	20-Oct-21	12:50	614	18	61		2,198
2		E-Coat 1/2 CT-T1	10-Nov-21	12:30	833	27	208	190	7,496
		E-Coat 1/2 CT-T2	10-Nov-21	12:40	833	27	171		6,163
3		E-Coat 1/2 CT-T1	22-Nov-21	12:50	838	32	80	78	2883
		E-Coat 1/2 CT-T2	22-Nov-21	12:57	838	32	75		2703
					Average:	***Shift Total***	***111***	**--**	***3994***
1	Phosphate Stage 5	Phosphate S5 - T1	20-Oct-21	13:24	614	145	61	64	407
		Phosphate S5 - T2	20-Oct-21	13:35	614	145	66		440
2		Phosphate S5 - T3	25-Oct-21	11:35	90	106	105	122	700
		Phosphate S5 - T4	25-Oct-21	11:46	90	106	138		920
3		Phosphate S5 - T3	22-Nov-21	11:50	838	248	225	251	1,501
		Phosphate S5 - T4	22-Nov-21	11:56	838	248	277		1,848
					Average:	***N/A***	***145***	**--**	***969***
1	Roof Exhaust 5	RF5-T1	20-Oct-21	13:22	614	N/A	38	36	344
		RF5-T2	20-Oct-21	13:32	614	N/A	33		299
2		RF5-T1	22-Nov-21	12:05	838	N/A	56	63	507
		RF5-T2	22-Nov-21	12:12	838	N/A	69		624
					Average:	***N/A***	***49***	**--**	***443***
1	Roof Exhaust 6	RF6-T1	21-Oct-21	11:04	604	N/A	46	46	280
2		RF6-T1	22-Nov-21	12:29	838	N/A	53	51	323
		RF6-T2	22-Nov-21	12:36	838	N/A	49		298
					Average:	***Shift Total***	***49***	**--**	***300***
1	52 Phosphate Stage 9	52 Phosphate Stage 9 T1	21-Oct-21	11:19	604	148	32	42	75
		52 Phosphate Stage 9 T2	21-Oct-21	11:26	604	148	52		122
2		52 Phosphate Stage 9 T3	25-Oct-21	11:06	90	106	69	69	162
		52 Phosphate Stage 9 T4	25-Oct-21	11:15	90	106	69		162
3		52 Phosphate Stage 9 T3	22-Nov-21	12:30	838	248	85	95	200
		52 Phosphate Stage 9 T4	22-Nov-21	12:35	838	248	105		247
					Average:	***Shift Total***	***69***	**--**	***161***
1	E-Coat Stage 3 UF Dip	E-Coat Stage 3 UF Dip T1	21-Oct-21	11:34	604	169	277	251	947
		E-Coat Stage 3 UF Dip T2	21-Oct-21	11:44	604	169	225		770
2		E-Coat Stage 3 UF Dip T3	25-Oct-21	11:20	90	100	85	77	291
		E-Coat Stage 3 UF Dip T4	25-Oct-21	11:28	90	100	69		236
					Average:	***Shift Total***	***164***	**--**	***561***

Table A1a: Odor Concentration, Emission Rates, and Production Rate Records

Round	Sample	ID	Sample Date	Time of Day	Paint Shop Production (total for day)	Hourly/Shift Production Previous hour from sample time	Odor Concentration (OU)	Average OU for same day sample	Odor Emission Rate (OU/s)
1	E-Coat Stage 1 Bypass	Ecoat Stage 1 Bypass T1	21-Oct-21	11:42	604	169	129	107	470
		Ecoat Stage 1 Bypass T2	21-Oct-21	11:45	604	169	85		309
1	Side Wall Exhaust Fan N6	Exhaust Fan N6 - T1	21-Oct-21	12:00	604	N/A	49	49	503
		Exhaust Fan N6 - T2	21-Oct-21	12:10	604	N/A	49		503
1	Sludge Room Garage Door	Garage Door T1	21-Oct-21	12:29	604	N/A	60	58	1293
		Garage Door T2	21-Oct-21	12:36	604	N/A	56		1207
1	North Corridor - Exhaust Fan 08 & 09	EF-08 T1	21-Oct-21	13:59	604	N/A	46	50	65
		EF-09-T1	21-Oct-21	13:47	604	N/A	53		75
1	RTO Outlet	RTO-T1	21-Oct-21	15:23	604	N/A	104	104	3884
		RTO-T2	21-Oct-21	15:29	604	N/A	104		3884
2		RTO-T1	22-Nov-21	13:50	838	N/A	121	181	4519
		RTO-T2	22-Nov-21	14:00	838	N/A	240		8964
3		RTO-T1	24-Nov-21	10:12	728	N/A	259	250	9674
		RTO-T2	24-Nov-21	10:25	728	N/A	241		9001
					Average:	***N/A***	***178***	--	***6655***
1	Exhaust Fan 10 & 1 (RTO and Elevator Shaft) Ground Level	EF10-T1	21-Oct-21	15:25	604	N/A	69	65	98
		EF1-T1	21-Oct-21	15:34	604	N/A	60		85
1	North Exhaust Corridor (Ground Level)	NE Exhaust T1	25-Oct-21	12:20	90	N/A	53	51	75
		NE Exhaust T2	25-Oct-21	12:28	90	N/A	49		70
1	RF#7	RF7 T1	10-Nov-21	12:55	833	N/A	216	203	1,955
		RF7 T2	10-Nov-21	13:10	833	N/A	189		1,710
1	RF#3	RF3 T1	10-Nov-21	11:14	833	N/A	402	382	3,638
		RF3 T2	10-Nov-21	11:20	833	N/A	361		3,267
1	RF#1	RF1 T1	10-Nov-21	10:40	833	N/A	160	156	1,448
		RF1 T2	10-Nov-21	10:50	833	N/A	152		1,376
1	Clearcoat 1 Oven Purge	CCP -1	4-Nov-21	12:00	632	N/A	391	391	59
1	Clearcoat 2 Oven Purge	CCP-2	4-Nov-21	12:10	632	N/A	681	681	102
1	Prime Oven 1 Purge	Prime Oven 1	4-Nov-21	12:25	632	N/A	481	481	72
1	Prime Oven 2 Purge	Prime Oven 2	4-Nov-21	12:35	632	N/A	449	449	67
1	E-Coat Oven 1 Purge	E-Coat Oven 1	4-Nov-21	13:00	632	N/A	449	449	67
1	E-Coat Oven 2 Purge	E-Coat Oven 2	4-Nov-21	12:56	632	N/A	340	340	51

Table A1b: Odor Characteristics & Hedonic Tone

Round	Sample	ID	Sample Date	Time of Day	Primary Descriptor	Specific Descriptors	Average Hedonic Tone	Range of Hedonic Tone
1	Clearcoat 2 Observation	CC2-T1	18-Oct-21	12:42	Medicinal, Chemical	Disinfectant, ammonia, floral, medicinal, paint, perfumy	-1	-4 to 3
		CC2-T2	18-Oct-21	13:00	Medicinal	Medicinal, almond, ammonia, car exhaust, chemical, citrus, disinfectant, floral, fruity, menthol, paint, petroleum, yeast	0	-3 to 2
2		CC2-T1	9-Nov-21	13:00	Chemical	Chemical, paint, sulfur, varnish	-1.4	-4 to 2
		CC2-T2	9-Nov-21	13:15	Chemical	Chemical, paint, disinfectant, petroleum, plastic	-1.4	-5 to 2
3		CC2-T1	19-Nov-21	9:19	Chemical	Chemical, petroleum, fruity	0.2	--
4		CC2-T2	22-Nov-21	11:45	Chemical	Chemical, confectionary, petroleum	0.7	--
		CC2-T1	22-Nov-21	11:56	Chemical	Chemical, confectionary, petroleum	0.5	--
1	Clearcoat 1 Observation	CC1-T1	18-Oct-21	12:39	Chemical	Ammonia, car exhaust, chalk-like, disinfectant, floral, herbal, medicinal	0	-2 to 2
		CC1-T2	18-Oct-21	12:53	Chemical	Chemical, eucalyptus, kerosene, paint, perfumy, soapy	3	3 to 10
2		CC1-T1	9-Nov-21	12:32	Chemical	Chemical, paint, plastic, turpentine, woody	-1.8	-6 to 2
		CC1-T2	9-Nov-21	12:40	Chemical	Chemical, paint, plastic, turpentine	-2	-7 to 2
3		CC1-T1	16-Nov-21	11:36	Chemical	Chemical	-1.9	--
		CC1-T2	16-Nov-21	11:38	Chemical	Chemical, fruity	-2.1	--
4		CC1-T1	18-Nov-21	16:06	Chemical	Chemical, fruity	-1.6	--
		CC1-T2	18-Nov-21	16:16	Chemical	Chemical, floral	-1.8	--
5		CC1-T1	19-Nov-21	9:49	Chemical	Chemical, petroleum, fruity	0.4	--
6		CC1-T1	22-Nov-21	11:16	Chemical	Chemical, confectionary, petroleum	0.7	--
		CC1-T2	22-Nov-21	11:22	Chemical	Chemical, confectionary	0.6	--
1	Concentrator Clean Air Exhaust	CCA-T1	18-Oct-21	13:24	Chemical	Chemical, mushroom, ammonia, gasoline	1	-3 to 9
		CCA-T2	18-Oct-21	13:36	Medicinal	Ammonia, fruity, medicinal, melon, plastic	2	-1 to 9
2		CCA-T1	25-Oct-21	10:00	Floral, Chemical	Chemical, almond, ammonia, chalk-like, cleaning fluids, floral, paint, vinyl	0	-1 to 2
		CCA-T2	25-Oct-21	10:10	Chemical	Chemical, almond, ammonia, cleaning fluids, floral, paint, soapy	-1	-2 to 2
3		CCA-T1	9-Nov-21	12:04	Chemical	Chemical, paint, varnish, vinyl	-2.8	9 to 2
		CCA-T2	9-Nov-21	12:12	Chemical	Chemical, grease, paint, plastic, varnish	-1.8	-7 to 2
4		CCA-T1	19-Nov-21	11:05	Chemical	Chemical, petroleum, fruity	-0.2	--
1	Rapid Repair	RR-T1	18-Oct-21	13:30	Earthy	Chalk-like, chemical, citrus, earthy, fruity, grease, kerosene, yeast	-2	-4 to 1
		RR-T2	18-Oct-21	13:44	Earthy	Ashes, burnt, chalk-like, earthy, medicinal, offensive, yeast	-2	-7 to 1
2		RR-T1	9-Nov-21	12:40	Chemical	Chemical, paint, petroleum, plastic, varnish	-1.2	-3 to 2
		RR-T2	9-Nov-21	12:36	Chemical	Chemical, grassy, paint, plastic, swampy	-1.6	-6 to 2
3		RR-T1	22-Nov-21	11:02	Chemical	Chemical, chalk-like, disinfectant, medicinal, menthol, paint, petroleum, solvent, varanish	-1.6	-7 to 2
		RR-T2	22-Nov-21	11:08	Chemical	Chemical, menthol, paint, petroleum, solvent, varnish, vinyl	-1.4	-7 to 2
1	Sludge Tank Exhaust	Sludge Tank T1	18-Oct-21	14:25	Chemical	Chemical, eucalyptus, paint, petroleum, pine	1	-3 to 7
		Sludge Tank T2	18-Oct-21	14:36	Chemical	Anesthetic, chemical, cleaning fluids, eucalyptus, medicinal, plastic	3	2 to 9
2		Sludge Tank T1	4-Nov-21	11:20	Chemical	Disinfectant, chemical, cleaning fluid, floral, paint, perfumy	-0.8	-3 to 3
		Sludge Tank T2	4-Nov-21	11:25	Chemical	Chemical, cleaning fluid, disinfectant, medicinal, oil, paint, perfumy	-0.4	-3 to 4
3		Sludge Tank T1	22-Nov-21	10:48	Chemical	Chemical, kerosene, offensive, oil, paint, rancid, solvent, vanish	-2	-7 to 2
		Sludge Tank T2	22-Nov-21	10:56	Chemical	Chemical,ashes, disinfectant, kerosene, molasses, paint, solvent	-2	-7 to 2
1	Desorb Purge Exhaust	Desorb Purge T1	18-Oct-21	14:24	Chemical	Apple, chemical, eucalyptus, floral, fruity, melon, molasses, oil, plastic	3	-4 to 9
		Desorb Purge T2	18-Oct-21	14:38	Fruity, Floral, Medicinal	Anesthetic, eucalyptus, fruity, medicinal, melon, plastic, solvent	3	-4 to 9
2		Desorb Purge T1	22-Nov-21	10:50	Chemical	Chemical, kerosene, ammonia, offfensive, paint, rancid, solvent	-2.6	-7 to 1
		Desorb Purge T2	22-Nov-21	10:55	Chemical	Chemical, cleaning fluid, disinfectant, kerosene, petroleum, solvent, varnish	-2.4	-7 to 1
1	Tutone Observation Exhaust	Tutone T1	18-Oct-21	15:09	Chemical	Chemical, eucalyptus, orange, paint, solvent	1	-4 to 8
		Tutone T2	18-Oct-21	15:25	Chemical	Eucalyptus, chemical, fruity, kerosene, melon, varnish	1	-1 to 2
2		Tutone T1	9-Nov-21	11:05	Chemical	Chemical, paint, ashes, disinfectant, medicinal, varnish	-2.8	-7 to 2
		Tutone T2	9-Nov-21	11:11	Chemical	Chemical, paint, gasoline, varnish, yeast	-2.2	-8 to 2
1	Basecoat 1 Observation	BC1-T1	19-Oct-21	11:54	Chemical	Chemical, earthy, paint, petroleum, solvent	-2.2	-5 to 0
		BC1-T2	19-Oct-21	12:07	Chemical	Paint, chemical, coconut, soapy	-1.2	-5 to 1
2		BC1-T1	9-Nov-21	11:20	Chemical	Chemical, grease, mushroom, paint, varnish	-2.6	-8 to 2
		BC1-T2	9-Nov-21	11:30	Chemical	Chemical, grease, oil, paint, plastic	-2.4	-7 to 2
1	Basecoat 2 Observation	BC2-T1	19-Oct-21	11:54	Chemical	Paint, chemical, perfumy	0.4	-5 to 9
		BC2-T2	19-Oct-21	12:09	Chemical	Paint, chemical, floral, perfumy, vinyl	0.8	-5 to 10
2		BC2-T3	25-Oct-21	10:20	Chemical	Chemical, almond, ammonia, cleaning fluids, floral, paint, vinyl	-1	-2 to 0
		BC2-T4	25-Oct-21	10:30	Chemical	Ammonia, chemical, cleaning fluids, paint	0	-2 to 2
3		BC2-T1	9-Nov-21	11:36	Chemical	Chemical, kerosene, paint, plastic, swampy	-1.2	-4 to 2
		BC2-T2	9-Nov-21	11:48	Chemical	Chemical, paint, soapy, varnish	-1.6	-4 to 2
1	Spot Prime Exhaust	SPRIME T1	19-Oct-21	12:30	Chemical	Paint, ashes, chemical, floral, herbal	0	-6 to 8
		SPRIME T2	19-Oct-21	12:36	Chemical	Chemical, paint, petroleum, sulfur	-2	-5 to 0
2		SPRIME T1	9-Nov-21	10:26	Chemical	Chemical, fruity, grape, paint, plastic, vinyl wood	-0.6	-3 to 2
		SPRIME T2	9-Nov-21	10:45	Chemical	Chemical, chalk-like, paint, plastic, varnish	-1	-4 to 2

Table A1b: Odor Characteristics & Hedonic Tone

Round	Sample	ID	Sample Date	Time of Day	Primary Descriptor	Specific Descriptors	Average Hedonic Tone	Range of Hedonic Tone
1	Phosphate 2B Exhaust	Phosphate 2B - T1	19-Oct-21	13:20	Chemical	Chemical, paint, chalk-like, petroleum	0	-5 to 9
		Phosphate 2B - T2	19-Oct-21	13:45	Chemical	Chemical, paint, earthy, smoky, vinyl	-0.4	-6 to 10
2		Phosphate 2B - T3	25-Oct-21	10:44	Chemical	Oil, chemical, floral, medicinal, nutty, plastic, soapy, spicy, vegetable	0	-2 to 2
		Phosphate 2B - T4	25-Oct-21	10:52	Chemical	Plastic, chemical, floral, grease, medicinal, nutty, soapy, spicy, vegetable	-1	-2 to 2
3		Phosphate 2B - T1	10-Nov-21	13:05	Chemical	Chemical sharp	-3	--
		Phosphate 2B - T2	10-Nov-21	13:15	Chemical	Chemical sharp	-3	--
1	Prime Oven 1/2 Cooling Tunnel	Prime Oven 1/2 CT T1	19-Oct-21	14:32	Chemical	Paint, chemical, cleaning fluid, herbal	-1.2	-5 to 2
		Prime Oven 1/2 CT T2	19-Oct-21	14:42	Chemical	Chemical, paint yeast	-1.6	-5 to 2
2		Prime Oven 1/2 CT T1	10-Nov-21	11:56	Burnt/plastic	--	-2	--
		Prime Oven 1/2 CT T2	10-Nov-21	11:59	Burnt/plastic	--	-2	--
3		Prime Oven 1/2 CT T1	22-Nov-21	13:23	Chemical	Chemical, plastic	-1	--
		Prime Oven 1/2 CT T2	22-Nov-21	13:36	Chemical	Chemical, plastic	-1.5	--
1	Clearcoat Oven 1/2 Cooling Tunnel	CC 1/2 CT T1	19-Oct-21	14:28	Chemical	Paint, chemical, plastic, varnish	1.2	-2 to 10
		CC 1/2 CT T2	19-Oct-21	14:39	Chemical	Chemical, paint, anesthetic, plastic	0.8	-4 to 10
2		CC 1/2 CT T1	10-Nov-21	12:10	paint/burnt	--	-2	--
		CC 1/2 CT T2	10-Nov-21	12:20	paint/burnt	--	-3	--
3		CC 1/2 CT T1	22-Nov-21	13:28	Chemical	Chemical, petroleum	-1.8	--
		CC 1/2 CT T2	22-Nov-21	13:42	Chemical	Chemical, plastics	-1.5	--
1	Phosphate Air Entrance	Phosphate ACE T1	19-Oct-21	13:55	Chemical	Chemical, paint, earthy, grease, herbal	0.8	-3 to 9
		Phosphate ACE T2	19-Oct-21	14:03	Chemical	Chemical, earthy, musky, paint, plastic	1	-3 to 10
2		Phosphate ACE T1	10-Nov-21	13:20	Chemical	Sharp	-3	--
		Phosphate ACE T2	10-Nov-21	13:28	Chemical	paint	-3	--
1	3rd Floor Wall Vent Northwest Wall	3F NWT1	20-Oct-21	11:20	Chemical	Ashes, chemical, floral, paint, perfumy, plastic, turpentine	-1.4	-4 to 1
		3F NWT2	20-Oct-21	11:25	Fruity, Chemical, Earthy	Chalk-like, fruity, grape, grease	-0.6	-1 to 0
2		3F NWT1	10-Nov-21	9:45	paint/chemical	--	-2	--
		3F NWT2	10-Nov-21	9:50	paint/sharp	--	-2	--
1	3rd Floor Wall Vent Northwest Wall	3F NWT3	20-Oct-21	11:36	Chemical	Chemical, medicinal, musky, paint, plastic, turpentine	-1.4	-3 to 0
		3F NWT4	20-Oct-21	11:41	Chemical	Chemical. Floral, paint, plastic, rose-like, turpentine, vinyl	-1.2	-3 to 0
2		3F NWT3	10-Nov-21	9:55	paint/chemical	--	-2	--
		3F NWT4	10-Nov-21	10:00	paint/solvent	--	-2	--
1	Roof Exhaust 2	RF2-T1	20-Oct-21	11:57	Chemical	Floral, plastic, turpentine, woody	0.6	-3 to 10
		RF2-T2	20-Oct-21	12:10	Chemical	Chemical, ammonia, floral, paint, plastic, turpentine	-1.4	-3 to 0
2		RF2-T1	10-Nov-21	10:58	paint/burnt/chemical	--	-3	--
		RF2-T2	10-Nov-21	11:06	chemical/burnt/paint	--	-3	--
3		RF2-T1	24-Nov-21	10:39	Chemical	Chemcal, chalk-like, cleaning fluid, grease, medicinal, oil, paint, solvent	-1	-5 to 0
		RF2-T2	24-Nov-21	10:46	Chemical	Chemical, cleaning fluid, medicinal, paint, petroleum	-2	-5 to 0
1	Roof Exhaust 4	RF4-T1	20-Oct-21	11:58	Chemical	Chemical, cleaning fluid, paint, plastic, turpentine	-1.2	-3 to 0
		RF4-T2	20-Oct-21	12:40	Chemical	Chemical, paint, alcohol, plastic, turpentine	-1.4	-3 to 0
2		RF4-T1	10-Nov-21	11:26	chemical	--	-2	--
		RF4-T2	10-Nov-21	11:30	burnt/chemical	--	-3	--
3		RF4-T1	24-Nov-21	10:35	Chemical	Chemical, cleaning fluids, kerosene, paint, yeast	-2	-6 to 0
		RF4-T2	24-Nov-21	10:45	Chemical	Chemical, ashes, cleaning flid, grease, paint, petroleum	-2	-6 to 0
1	E-Coat Oven 1/2 Cooling Tunnel	E-Coat 1/2 CT-T1	20-Oct-21	12:40	Chemical	Ammonia. Chemical, earthy, mushroom, paint, plastic, soap[y	-1.4	-3 to 0
		E-Coat 1/2 CT-T2	20-Oct-21	12:50	Chemical	Chemical, earthy, paint, plastic, swampy, turpentine, yeast	-1.4	-3 to 0
2		E-Coat 1/2 CT-T1	10-Nov-21	12:30	paint/plastic/burnt	--	-2	--
		E-Coat 1/2 CT-T2	10-Nov-21	12:40	burnt	--	-2	--
3		E-Coat 1/2 CT-T1	22-Nov-21	12:50	Chemical	Chemical, plastic, petroleum	-1.5	--
		E-Coat 1/2 CT-T2	22-Nov-21	12:57	Chemical	Chemical, petroleum, plastics, medicinal	-0.9	--
1	Phosphate Stage 5	Phosphate S5 - T1	20-Oct-21	13:24	Chemical	Ammonia, chemical, medicinal, paint, plastic, solvent	-0.8	-2 to 0
		Phosphate S5 - T2	20-Oct-21	13:35	Chemical	Alcohol, chemical, chlorinous, disinfectant, medicinal, molasses, plastic	-2	-5 to 0
2		Phosphate S5 - T3	25-Oct-21	11:35	Vegetable, Chemical	Vegetable, chemical, cucumber, floral, medicinal, nutty, paint, soapy, spicy, varnish	0	-3 to 2
		Phosphate S5 - T4	25-Oct-21	11:46	Vegetable	Vegetable, celery, chemical, floral, medicinal, musty, nutty, paint, soapy, spicy	0	-3 to 2
3		Phosphate S5 - T3	22-Nov-21	11:50	Chemical	Chemical, medicinal, disinfectant, menthol, plastic, solvent, vinyl	0	-7 to 4
		Phosphate S5 - T4	22-Nov-21	11:56	Chemical	Medicinal, solvent, chemical, disinfectant, menthol, varnish	0	-7 to 4
1	Roof Exhaust 5	RF5-T1	20-Oct-21	13:22	Chemical	Alcohol, ammonia, chemical, grease, molasses, plastic	-1.8	-4 to 0
		RF5-T2	20-Oct-21	13:32	Chemical	Chemical, ammonia, molasses, oil, plastic, tar	-2.2	-3 to 0
2		RF5-T1	22-Nov-21	12:05	Medicinal	Chemical, medicinal, menthol, paint, varnish, vinegar, woody	-1.2	-7 to 2
		RF5-T2	22-Nov-21	12:12	Medicinal	Anesthetic, chemical, citrus, disinfectant, fruity, medicinal, menthol, varnish, vinegar	-0.8	-7 to 2

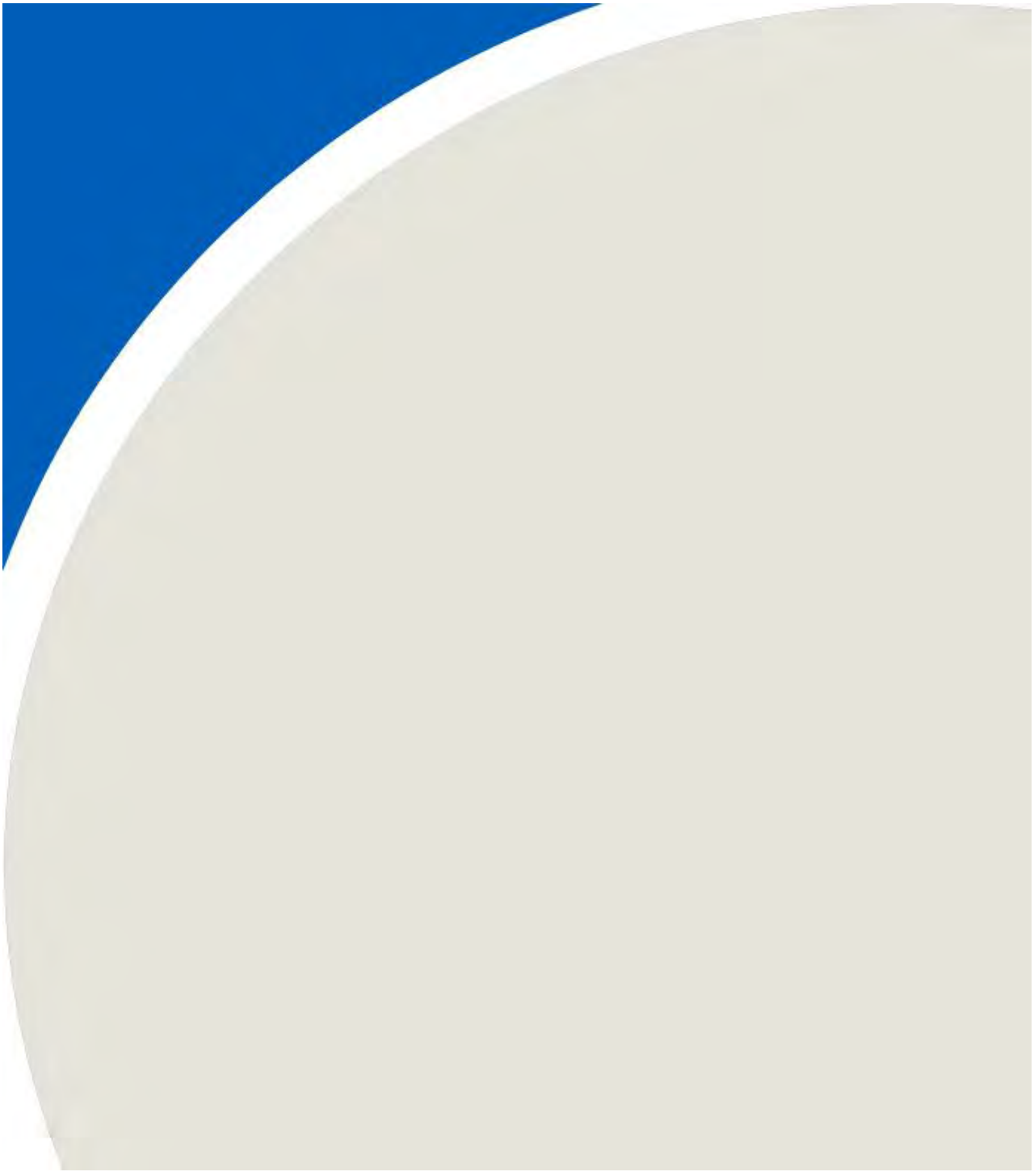
Table A1b: Odor Characteristics & Hedonic Tone

Round	Sample	ID	Sample Date	Time of Day	Primary Descriptor	Specific Descriptors	Average Hedonic Tone	Range of Hedonic Tone
1	Roof Exhaust 6	RF6-T1	21-Oct-21	11:04	Chemical	Chemical, paint, ammonia, chalk-like, earthy, grassy	-2	-4 to 0
2		RF6-T1	22-Nov-21	12:29	Chemical	Chemical, medicinal, menthol, paint, petroleum, yeast	-1.2	-7 to 2
		RF6-T2	22-Nov-21	12:36	Chemical	Chemical, cleaning fluid, fruity, orange, soapy, solvent, varnish	-0.8	-7 to 2
1	52 Phosphate Stage 9	52 Phosphate Stage 9 T1	21-Oct-21	11:19	Chemical	Chemical, ammonia, cleaning fluid, fruity, grape, paint	-2	-6 to 1
		52 Phosphate Stage 9 T2	21-Oct-21	11:26	Chemical	Ammonia, anesthetic, chemical, earthy, paint, smoky	-2	-7 to 0
2		52 Phosphate Stage 9 T3	25-Oct-21	11:06	Chemical	Chemical, paint, ammonia, nutty, petroleum	-1	-3 to 2
		52 Phosphate Stage 9 T4	25-Oct-21	11:15	Chemical	Chemical, paint, celery, nutty, vegetable, woody	0	-3 to 2
3		52 Phosphate Stage 9 T3	22-Nov-21	12:30	Fruity	Fruity, solvent, chemical, citrus, cleaning fluid, orange	-0.4	-7 to 3
		52 Phosphate Stage 9 T4	22-Nov-21	12:35	Chemical	Fruity, chemical, kerosene, melon, orange, plastic, solvent	-1.2	-7 to 3
1	E-Coat Stage 3 UF Dip	E-Coat Stage 3 UF Dip T1	21-Oct-21	11:34	Fruity	Chemical, fruity, mushroom, nutty, orange, paint, vanilla, vegetable	3	-1 to 8
		E-Coat Stage 3 UF Dip T2	21-Oct-21	11:44	Chemical	Fruity, molasses, nutty orange, paint, vegetable, vinyl	2	-2 to 4
2		E-Coat Stage 3 UF Dip T3	25-Oct-21	11:20	Chemical	Chemical, paint, celery, nutty, solvent, vegetable	0	-3 to 3
		E-Coat Stage 3 UF Dip T4	25-Oct-21	11:28	Chemical	Chemical, disinfectant, floral, medicinal, mushroom, paint, soapy, spicy, vegetable, vinyl	-1	-3 to 2
1	E-Coat Stage 1 Bypass	Ecoat Stage 1 Bypass T1	21-Oct-21	11:42	Chemical	Chemical, ammonia, cleaning fluid, molasses, nutty, paint, soapy, vegetable	0	-3 to 2
		Ecoat Stage 1 Bypass T2	21-Oct-21	11:45	Chemical	Chemical, ammonia, cleaning fluid, kerosene, molasses, nutty, paint vegetable	0	-3 to 1
1	Side Wall Exhaust Fan N6	Exhaust Fan N6 - T1	21-Oct-21	12:00	Chemical	Chemical, ammonia, petroleum, plastic, solvent	0	-4 to 10
		Exhaust Fan N6 - T2	21-Oct-21	12:10	Chemical	Chemical, car exhaust, kerosene, oil, paint	-2	-5 to 0
1	Sludge Room Garage Door	Garage Door T1	21-Oct-21	12:29	Chemical	Chemical, car exhaust, gasoline, paint	-2	-5 to 0
		Garage Door T2	21-Oct-21	12:36	Chemical	Chemical, gasoline, paint, petroleum, sulfur	-1	-3 to 0
1	North Corridor - Exhaust Fan 08 & 09	EF-08 T1	21-Oct-21	13:59	Chemical	Chemical, petroleum, chalk-like, fishy, offensive, paint, plastic	-2	-4 to 0
		EF-09-T1	21-Oct-21	13:47	Chemical	Chemical, gasoline, mushroom, paint, petroleum, plastic	-2	-5 to 0
1	RTO Outlet	RTO-T1	21-Oct-21	15:23	Chemical	Chemical, car exhaust, disinfectant, petroleum, plastic	-3	-5 to 0
		RTO-T2	21-Oct-21	15:29	Chemical	Chemical, car exhaust, chlorinous, fishy, petroleum, plastic, yeast	-3	-8 to 0
2		RTO-T1	22-Nov-21	13:50	Chemical	Chemical, gasoline, paint, plasic, solvent, swampy	-2.2	-7 to 2
		RTO-T2	22-Nov-21	14:00	Chemical	Chemical, petroleum	-1.7	--
3		RTO-T1	24-Nov-21	10:12	Chemical	Chemical, anesthetic, ashes, chlorinus, cleaning fluid, gasoline, kerosene, medicinal, solvent	0	-2 to 2
		RTO-T2	24-Nov-21	10:25	Chemical	Chemical, kerosene, solvent, cleaning flid, gasoline, medicinal	-1	-5 to 2
1	Exhaust Fan 10 & 1 (RTO and Elevator Shaft) Ground Level	EF10-T1	21-Oct-21	15:25	Chemical	Plastic, chemical, fishy, paint, petroleum	-3	-6 to 0
		EF1-T1	21-Oct-21	15:34	Chemical	Chemical, plastic, fishy, paint, petroleum, varnish	-3	-6 to 0
1	North Exhaust Corridor (Ground Level)	NE Exhaust T1	25-Oct-21	12:20	Floral, chemical	Floral, chemical, grease, medicinal, nutty, soapy, spicy, vegetable, yeast	0	-3 to 3
		NE Exhaust T2	25-Oct-21	12:28	Vegetable, medicinal, earthy	Vegetable, ammonia, anesthetic, earthy, floral, medicinal, onion, smoky, soapy, spicy	-1	-3 to 2
1	RF#7	RF7 T1	10-Nov-21	12:55	Chemical	--	-2	--
		RF7 T2	10-Nov-21	13:10	Chemical	--	-2	--
1	RF#3	RF3 T1	10-Nov-21	11:14	Chemical	paint/solvent/sharp	-3	--
		RF3 T2	10-Nov-21	11:20	Chemical	paint/solvent/sharp	-3	--
1	RF#1	RF1 T1	10-Nov-21	10:40	paint/solvent/sharp	--	-2	--
		RF1 T2	10-Nov-21	10:50	paint/solvent/sharp	--	-2	--
1	Clearcoat 1 Oven Purge	CCP -1	4-Nov-21	12:00	Chemical	Chemical, cleaning fluid, disinfectant, medicinal, paint, solvent	-2.6	-6 to 0
1	Clearcoat 2 Oven Purge	CCP-2	4-Nov-21	12:10	Chemical	Chemical, cleaning fluid, fruity, lemon, varnish, yeast	-1	-3 to 3
1	Prime Oven 1 Purge	Prime Oven 1	4-Nov-21	12:25	Chemical	Chemical, cleaning fluid, ashes, disinfectant, medicinal, paint, plastic	-1	-3 to 2
1	Prime Oven 2 Purge	Prime Oven 2	4-Nov-21	12:35	Chemical	Chemical, cleaning fliud, disinfectant, medicinal, paint, plastic, varnish	-2	-3 to 0
1	E-Coat Oven 1 Purge	E-Coat Oven 1	4-Nov-21	13:00	Chemical	Chemcial, cleaning fluid, paint, plastic, varnish	-1	-3 to 2
1	E-Coat Oven 2 Purge	E-Coat Oven 2	4-Nov-21	12:56	Chemical	Ashes, disinfectant, medicinal, plastic	-1.6	-3 to 0

Table A2: Summary of Source Parameters

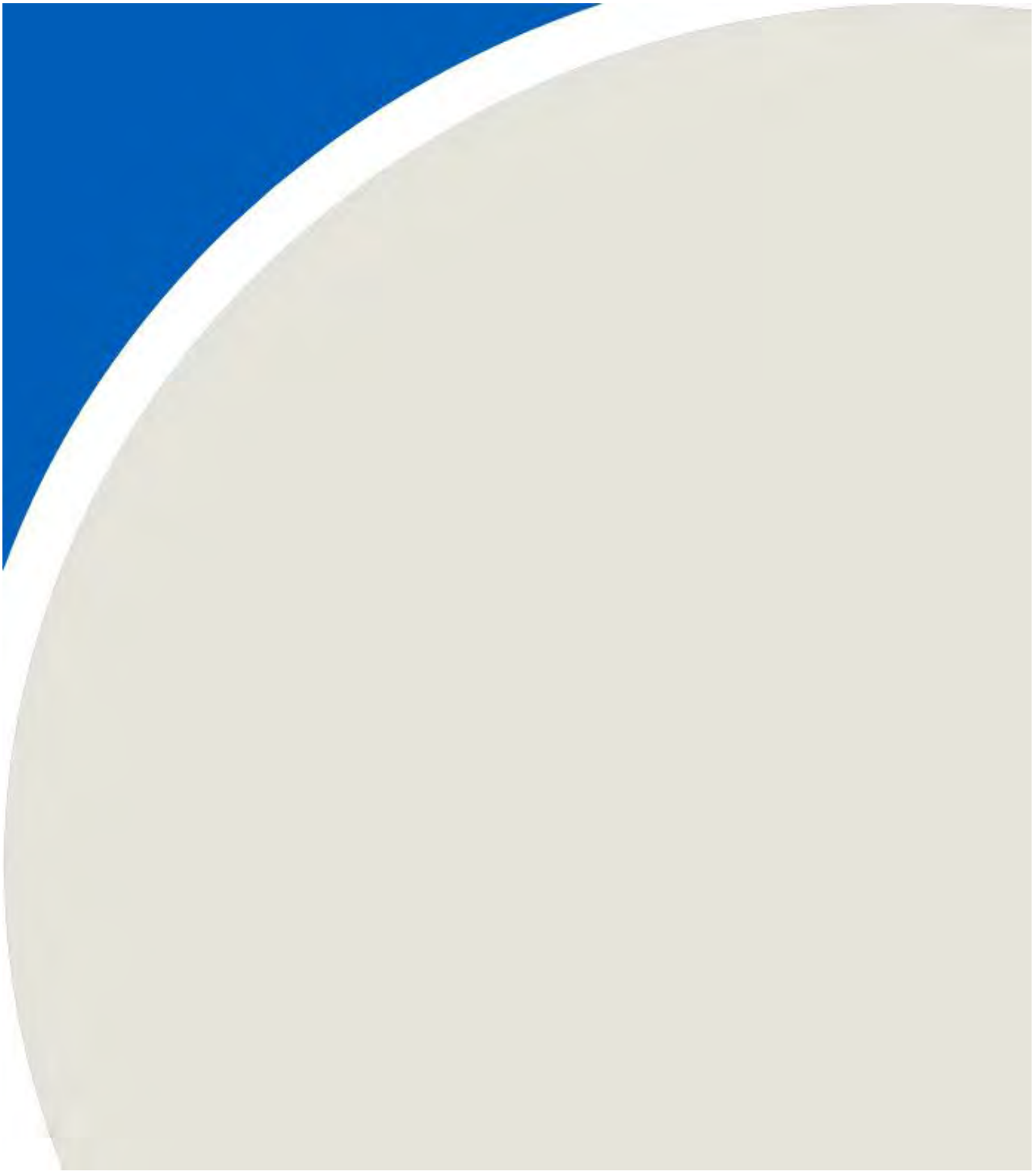
Sample	ID	Flow Rate (Wet,Ref)		Stack Diameter		Area Source		Stack Height above grade		Temperature	
		(m3/s)	(CFM)	(m)	(")	(" x ")	(m x m)	(m)	(ft)	(°C)	(°F)
Clearcoat 2 Observation	CC2-T1	10.93	23,156	1.02	40	--	--	37	120	29	85
Clearcoat 1 Observation	CC1-T1	11.92	25,253	1.02	40	--	--	37	120	29	85
Concentrator Clean Air Exhaust	CCA-T1	45.31	95,987	2.13	84	--	--	40	130	33	92
Rapid Repair	RR-T1	32.46	68,762	1.98	78	--	--	37	120	25	77
Sludge Tank Exhaust	Sludge Tank T1	4.44	9,408	0.66	26	--	--	37	120	29	85
Desorb Purge Exhaust	Desorb Purge T1	0.15	327	0.46	18	--	--	40	130	29	85
Tutone Observation Exhaust	Tutone T1	14.45	30,619	1.12	44	--	--	37	120	29	85
Basecoat 1 Observation	BC1-T1	9.02	19111	0.91	36	--	--	37	120	29	85
Basecoat 2 Observation	BC2-T1	9.92	21011	0.91	36	--	--	37	120	29	85
Spot Prime Exhaust	SPRIME T1	16.36	34660	1.27	50	--	--	37	120	29	85
Phosphate 2B Exhaust	Phosphate 2B - T1	4.82	10213	0.66	26	--	--	30	100	54	129
Prime Oven 1/2 Cooling Tunnel	Prime Oven 1/2 CT T1	33.41	70775	1.93	76	--	--	37	120	35	95
Clearcoat Oven 1/2 Cooling Tunnel	CC 1/2 CT T1	29.09	61627	2.03	80	--	--	37	120	35	95
Phosphate Air Entrance	Phosphate ACE T1	1.42	3001	0.46	18	--	--	30	100	33	92
3rd Floor Wall Vent Northwest Wall	3F NWT1	1.03	2175	--	--	33 x 33	0.84 x 0.84	27	90	29	85
3rd Floor Wall Vent Northwest Wall	3F NWT3	1.03	2192	--	--	33 x 33	0.84 x 0.84	27	90	29	85
Roof Exhaust 2	RF2-T1	22.88	48473	1.52	60	--	--	25	83	29	85
Roof Exhaust 4	RF4-T1	21.51	45567	1.52	60	--	--	25	83	29	85
E-Coat Oven 1/2 Cooling Tunnel	E-Coat 1/2 CT-T1	36.04	76359	1.93	76	--	--	37	120	35	95
Phosphate Stage 5	Phosphate S5 - T1	6.67	14125	0.76	30	--	--	30	100	38	100
Roof Exhaust 5	RF5-T1	9.05	19172	1.07	42	--	--	20	65	35	95
Roof Exhaust 6	RF6-T1	6.09	12899	0.91	36	--	--	20	65	29	85
52 Phosphate Stage 9	52 Phosphate Stage 9 T1	2.35	4910	0.51	20	--	--	30	100	35	95
E-Coat Stage 3 UF Dip	E-Coat Stage 3 UF Dip T1	3.42	7248	0.66	26	--	--	30	100	35	95
E-Coat Stage 1 Bypass	Ecoat Stage 1 Bypass T1	3.64	7715	0.46	18	--	--	30	100	29	85
Side Wall Exhaust Fan N6	Exhaust Fan N6 - T1	10.27	21760	--	--	40 x 40	1.02 x 1.02	5	15	29	85
Sludge Room Garage Door	Garage Door T1	21.55	45666	--	--	146 x 192	3.71 x 4.88	2	8	29	85
North Corridor - Exhaust Fan 08 & 09	EF-08 T1	1.42	1000	0.41	16	--	--	3	10	29	85
	EF-09-T1	1.42	1000	0.41	16	--	--	3	10	29	85
RTO Outlet	RTO-T1	37.35	79175	1.73	68	--	--	40	130	159	318
Exhaust Fan 10 & 1 (RTO and Elevator Shaft) Ground Level	EF10-T1	1.42	2175	--	--	33 x 33	0.84 x 0.84	5	15	29	85
	EF1-T1	1.42	2175	--	--	33 x 33	0.84 x 0.84	5	15	29	85
North Exhaust Corridor	NE Exhaust T1	1.42	1,000	--	--	33 x 33	0.84 x 0.84	2	8	29	85
RF#7	RF7 T1	9.05	19172	1.07	42	--	--	20	65	35	95
RF#3	RF3 T1	9.05	19172	1.07	42	--	--	20	65	35	95
Clearcoat 1 Oven Desorb	CCP -1	0.15	327	0.46	18	--	--	40	130	29	85
Clearcoat 2 Oven Desorb	CCP-2	0.15	327	0.46	18	--	--	40	130	29	85
Prime Oven 1 Desorb	Prime Oven 1	0.15	327	0.46	18	--	--	40	130	29	85
Prime Oven 2 Desorb	Prime Oven 2	0.15	327	0.46	18	--	--	40	130	29	85
E-Coat Oven 1 Desorb	E-Coat Oven 1	0.15	327	0.46	18	--	--	40	130	29	85
E-Coat Oven 2 Desorb	E-Coat Oven 2	0.15	327	0.46	18	--	--	40	130	29	85
RF#1	RF1 - T1	9.05	19172	1.07	42	--	--	20	65	35	95

APPENDIX B: LABORATORY REPORTS



APPENDIX B1:

October 18, 2021 Laboratory Results



APPENDIX B2:

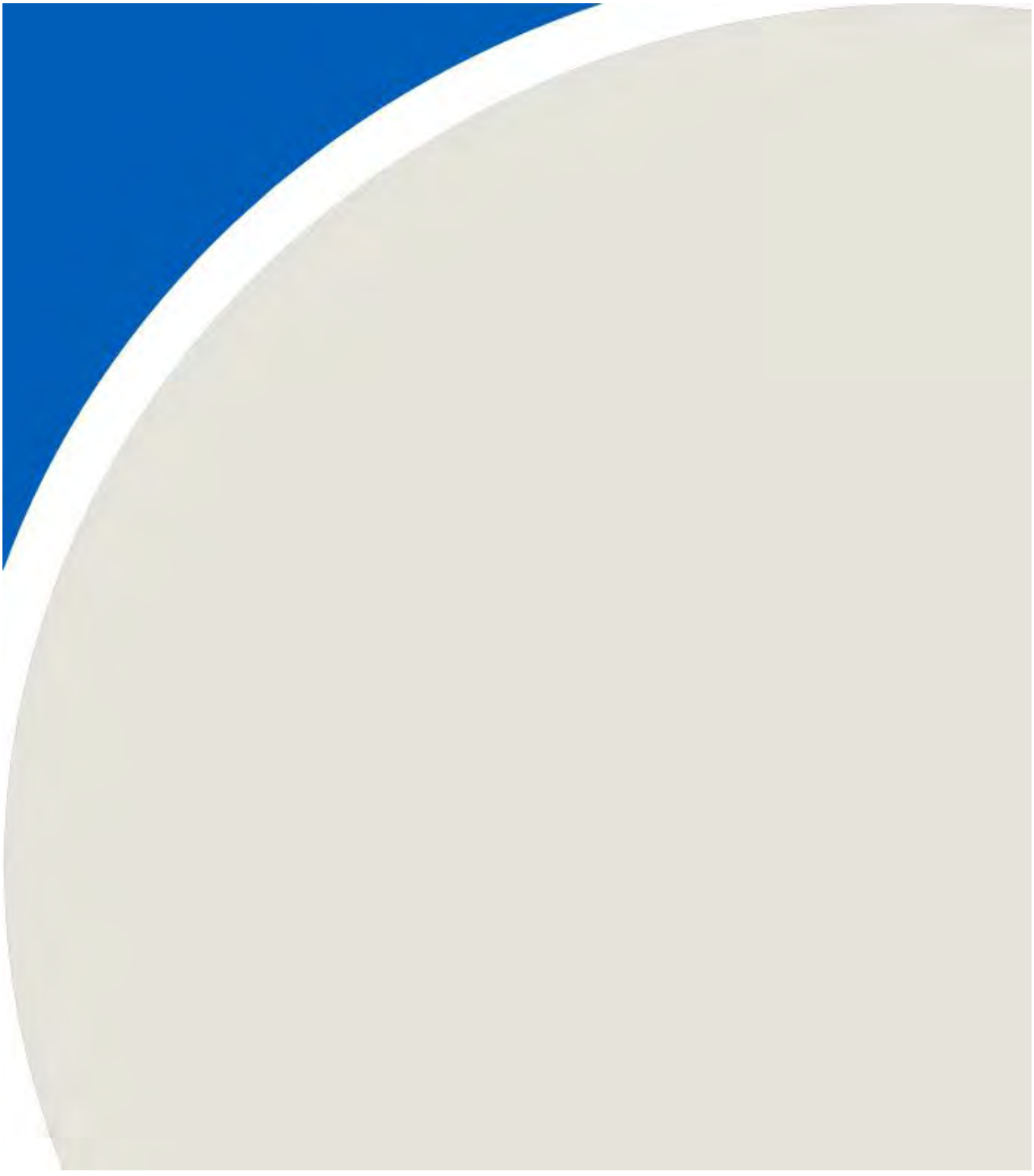
October 19, 2021 Laboratory Report

APPENDIX B3:

October 20, 2021 Laboratory Report

APPENDIX B4:

October 21, 2021 Laboratory Report

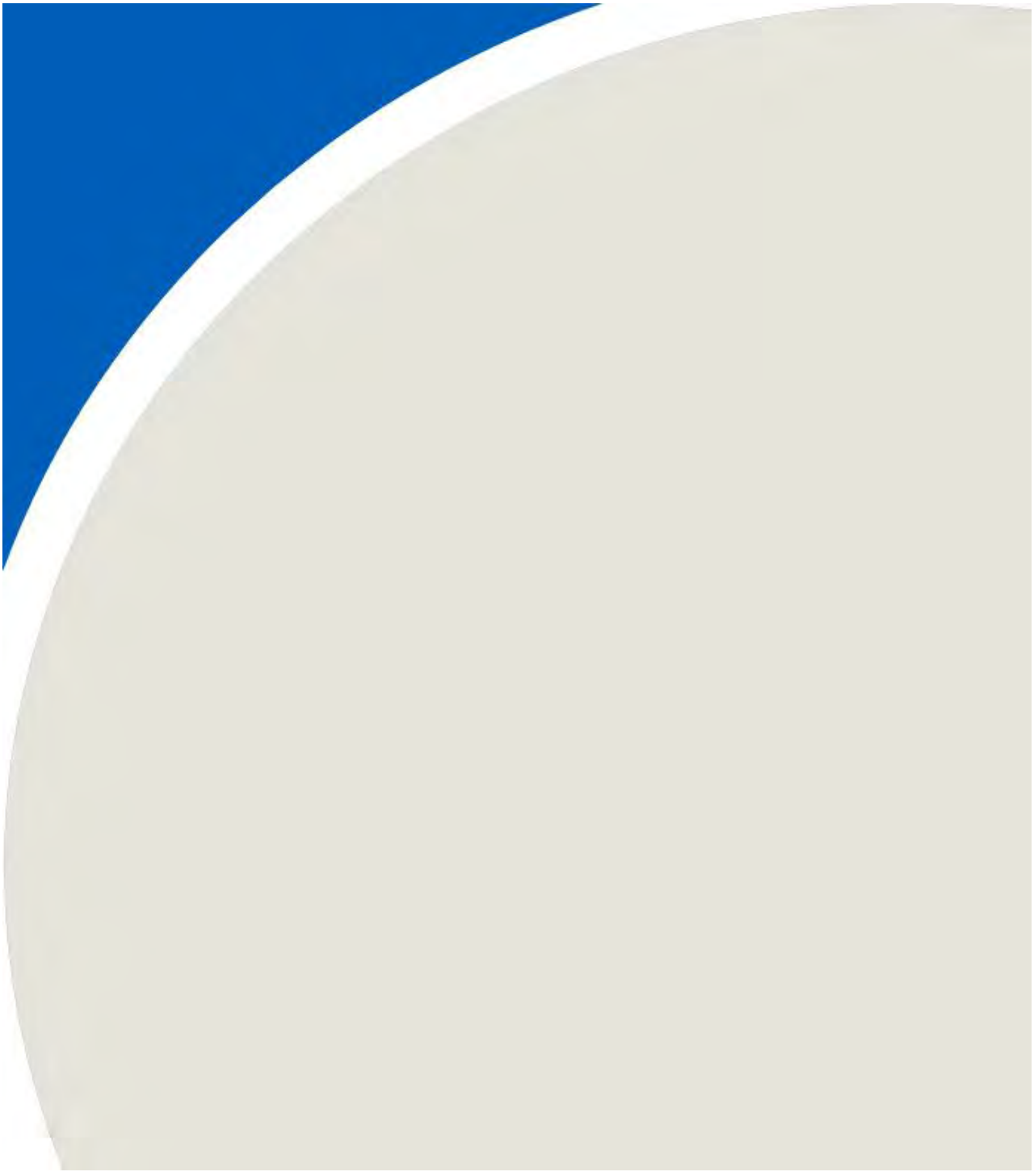


APPENDIX B5:

October 25, 2021 Laboratory Report

APPENDIX B6:

November 4, 2021 Laboratory Report

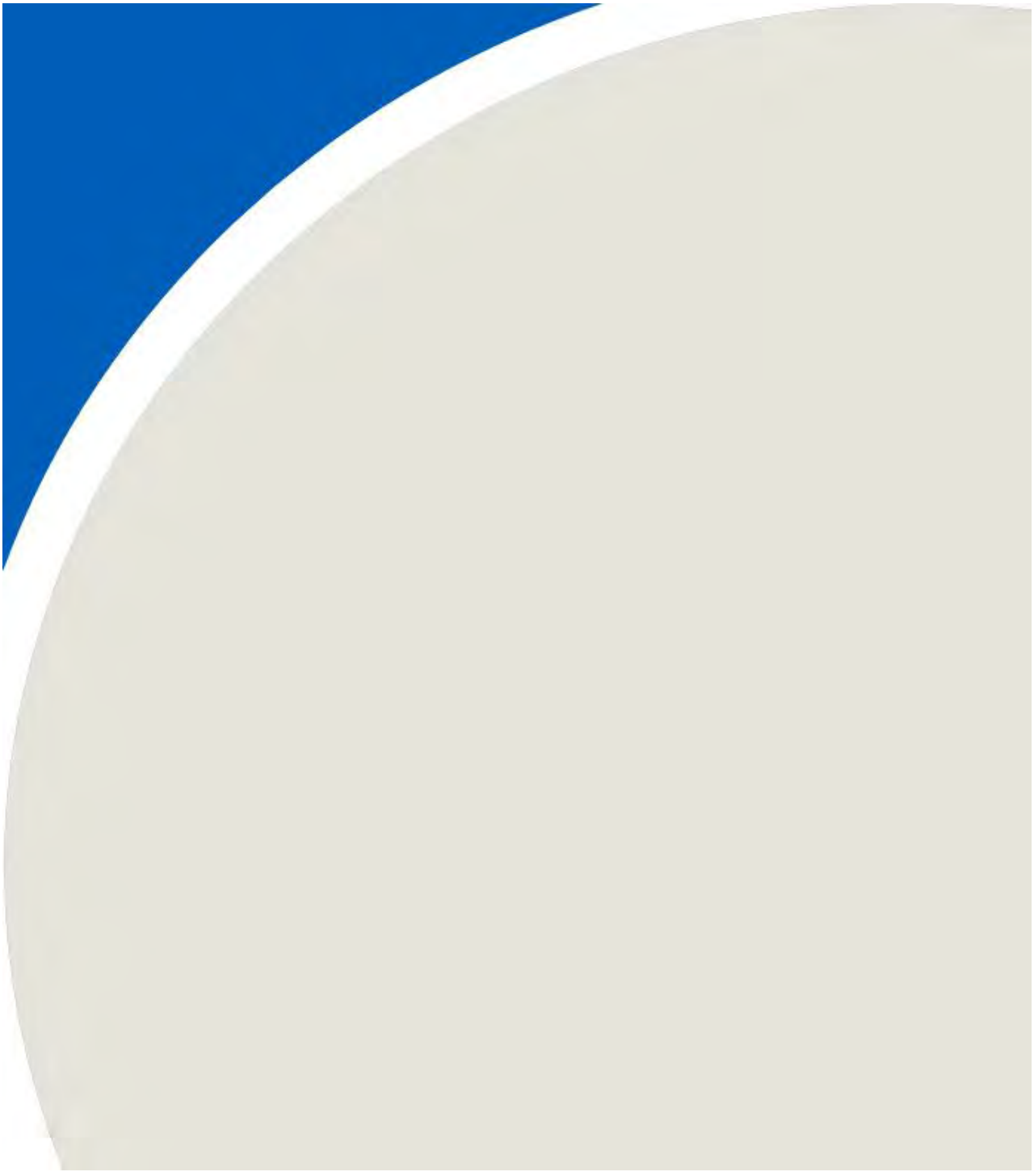


APPENDIX B7:

November 9, 2021 Laboratory Report

APPENDIX B8:

November 10, 2021 Laboratory Report



APPENDIX B9:

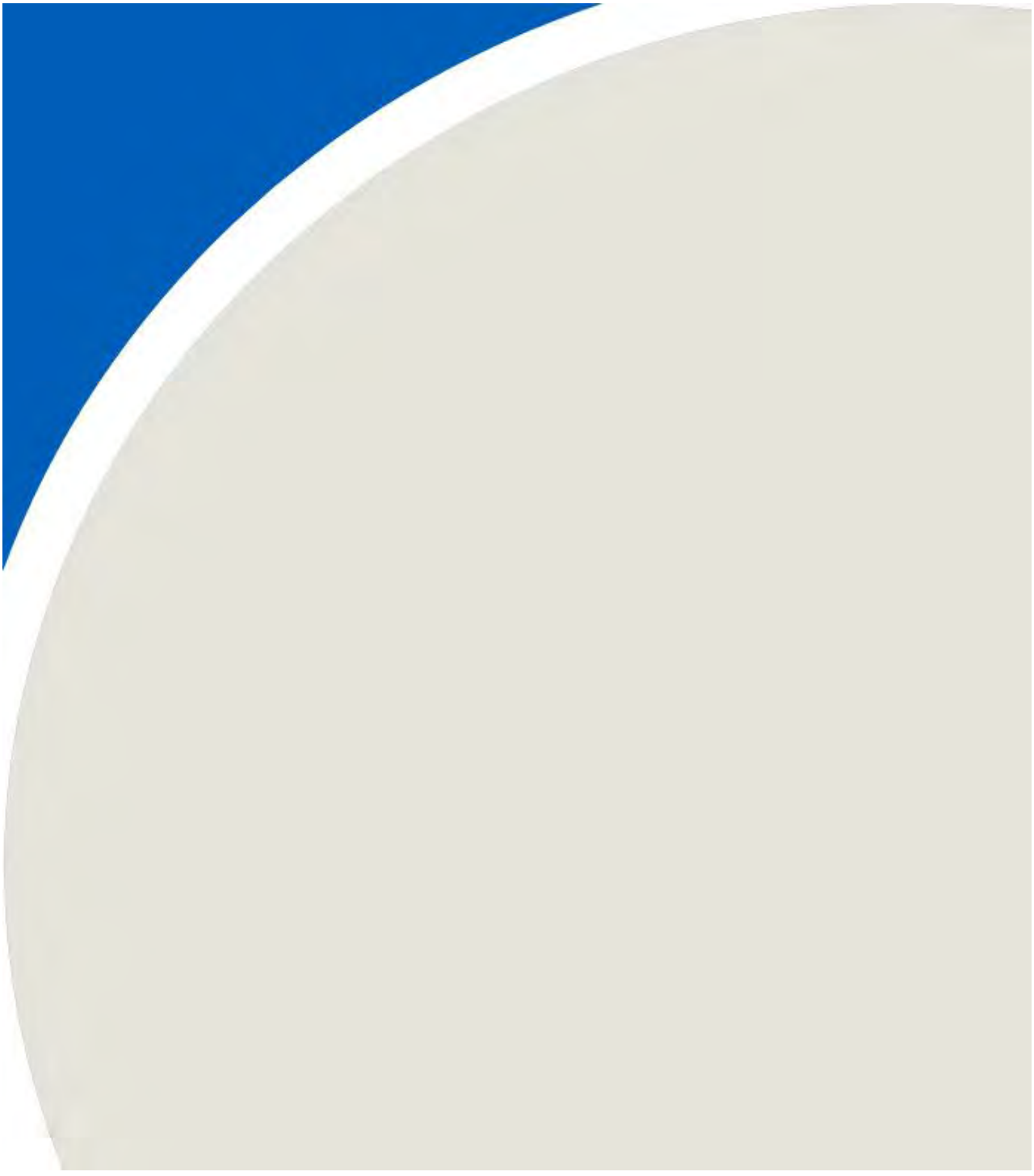
November 16, 2021 Laboratory Report

APPENDIX B10:

November 18, 2021 Laboratory Report

APPENDIX B11:

November 19, 2021 Laboratory Report



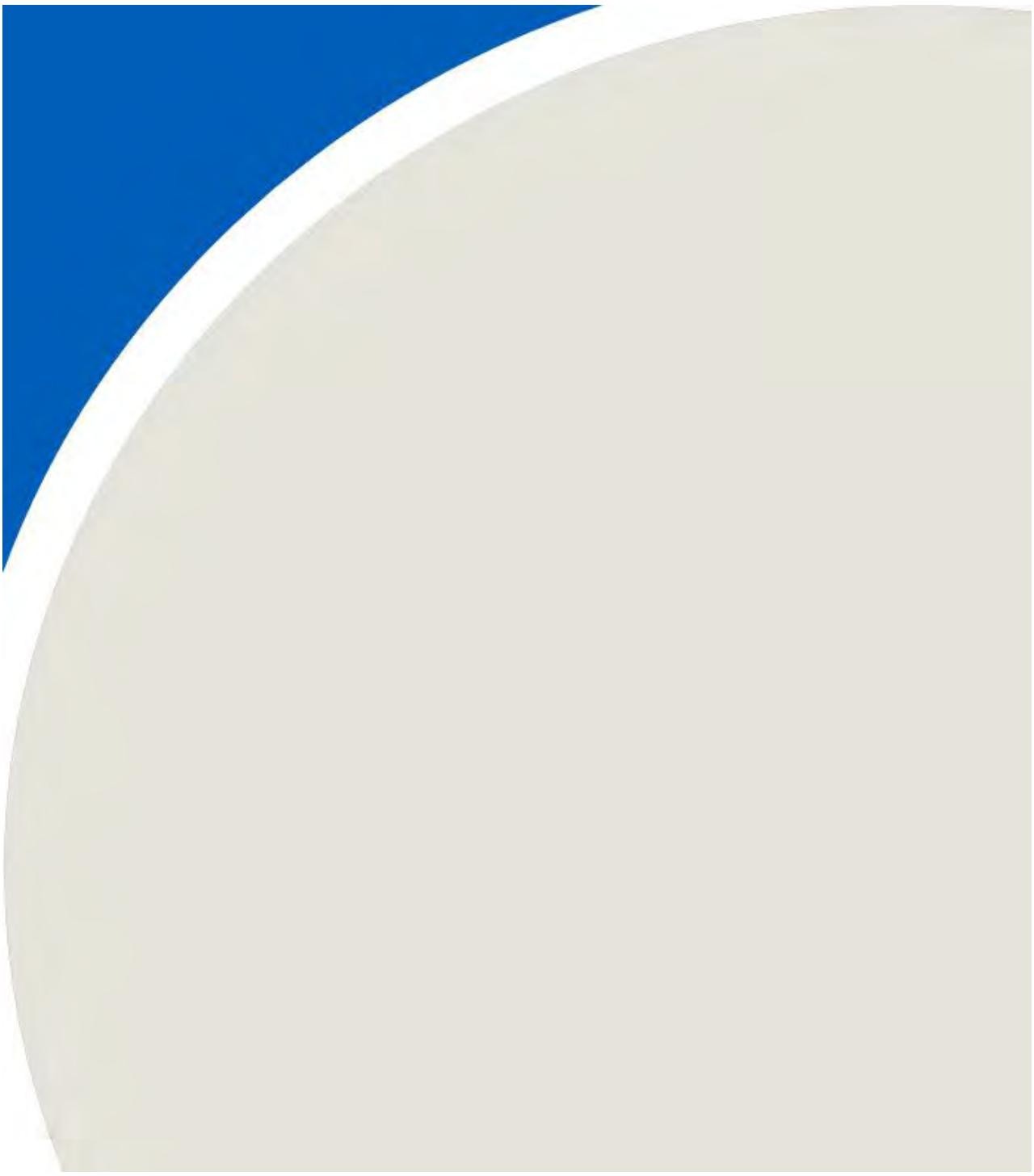
APPENDIX B12:

November 22, 2021 Laboratory Report

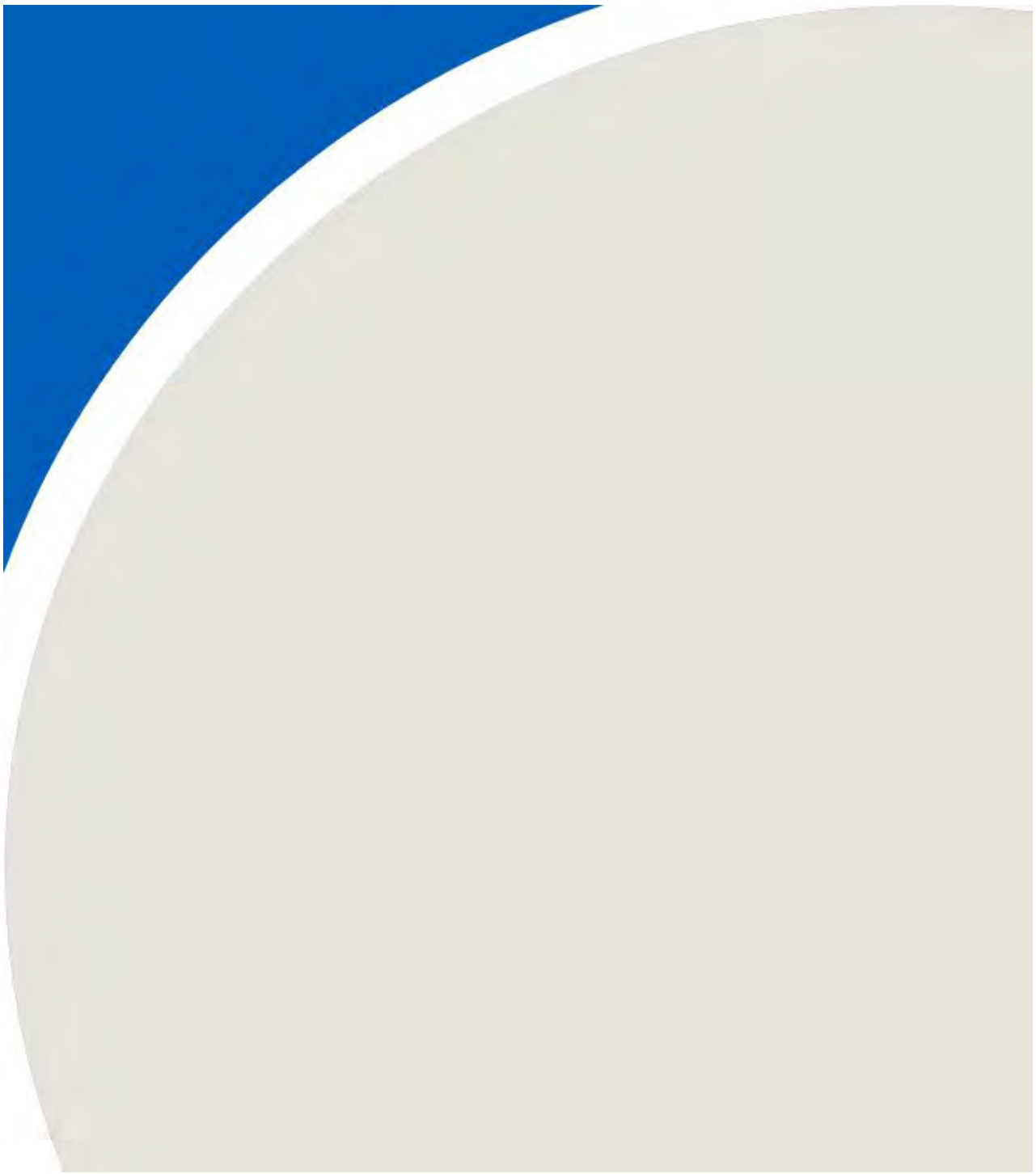
APPENDIX B13:

November 24, 2021 Laboratory Report

APPENDIX C: FLOW RATE RESULTS



APPENDIX D: CALIBRATION RECORDS



APPENDIX E: FIELD NOTES