ZDHC

ZDHC Air Emissions Position Paper

Version 1.0

January 2021

DISCLAIMERS

Whilst ZDHC takes every reasonable effort to make sure that the content of this Position Paper is as accurate as possible, ZDHC makes no claims, promises, or guarantees about the accuracy, completeness, or adequacy of the contents of this ZDHC Air Emissions Position Paper.

In no event will ZDHC (and/or any related ZDHC majority owned legal entities) or the Directors or staff thereof be liable and ZDHC expressly disclaims any liability of any kind to any party for any loss, damage, or disruption caused:

a. by errors or omissions, whether such errors or omissions result from negligence, accident, or any other cause and/or
b. from any use, decision made, or action taken or any other kind of reliance on the ZDHC Air Emissions Position Paper by a reader or user of it and/or
c. for any results obtained or not obtained from the use of the ZDHC Air Emissions Position Paper.

The ZDHC Foundation has prepared this document to support environmental stewardship initiatives. This document is not intended as a statement of legal requirements.

It is not the intent of the ZDHC Foundation to act as an agency reporting data to governments or authorities having jurisdiction. It is expected that manufacturing facilities are accountable for reporting on their discharges, in accordance with applicable laws.

ZDHC will not verify compliance but facilities are expected to:

1. Have a valid license to operate.
2. Comply with air emissions permit at all times:
   a. Applicable to process emissions from manufacturing facilities.
   b. Applicable to onsite facilities emissions, excluding wastewater and sludge.
   c. It is prohibited to dilute any air emissions from exhausted systems to purposefully minimise concentrations.
   d. If any emissions of process and facilities operations originates in the same place (i.e. in a large, open-planned facility), requirements and best practices shall apply to both systems (including more-strict limitations).

Definitions

To help understand its documents ZDHC has adopted unified definitions to technical and non-technical terminologies often used. These definitions are part of the ZDHC Glossary.

Abbreviations

Throughout the document, some abbreviations are often used. Refer to these abbreviations to aid in understanding.

DRE Destruction Removal Efficiency
EF Emissions Factor
FTIR Fourier-transform infrared spectroscopy
GC Gas Chromatography
GHG Greenhouse Gases
HAP Hazardous Air Pollutants
N/A Not Available or Not Applicable
ODS Ozone Depleting Substances
PM Particulate Matter
PTE Potential to Emit
RL Reporting Limit
TOC Total Organic Carbon
USEPA United States Environmental Protection Agency
VOC Volatile Organic Compound
WHO World Health Organization

Related Work

This document is one part of a series of solutions provided by ZDHC. Manufacturing facilities are recommended to address the solutions applicable to them, considering the type of processes conducted in their facility.

For that the following documents must be taken into account:

- ZDHC Manufacturing Restricted Substances List (ZDHC MRSL)
- ZDHC CMS Framework
- ZDHC CMS Technical Industry Guide
- Chemical Inventory List (CIL)
- ZDHC MMCF Air Emissions Guidelines

Contents

ZDHC Air Emission Position Paper
Version 1.0 | January 2021

Summary

This ZDHC Air Emissions Position Paper is an important step on our journey to create a holistic approach for output related emissions. This paper focuses on two types of air emissions: those generated in a facility that are related to its operation (any sort of combustion or other air emissions sources) and process operations emissions (related to production process, production line equipment and manufacturing processes).

With this Position Paper we aim to reinforce expectations, highlight areas of opportunity, and propel the industry towards greater responsibility to control the industry's impact on communities and the environment. The term "Position Paper" has been chosen to illustrate the diligence and effort in preparing this document but also to acknowledge that the limits and recommendations shared here are meant to give directionality to the industry and at this time, are not required to be reported using the ZDHC platforms[1].

ZDHC will continue to work on a streamlined reporting mechanism, monitoring requirements, and testing so that this document will transition into the ZDHC Air Emissions Guidelines.

[1] This decision was not taken lightly. While we aim to the highest value in building robust air emissions programmes, we also acknowledge immense stressors upon all the stakeholders of our community, not least COVID-19, global travel restrictions, impacts to revenues and employment.

1. Introduction

The ZDHC Foundation oversees implementation of the Roadmap to Zero Programme and is a global industry collaboration of brands, value chain affiliates, and associates within the sports, fashion, luxury and outdoor industry.

The vision is widespread implementation of sustainable chemistry, driving innovation and best practices in the textile, apparel, leather and footwear industries to protect consumers, workers and the environment. Through collaborative engagement, standard setting and large-scale implementation ZDHC advances the industry towards zero discharge of hazardous chemicals. ZDHC takes a holistic approach to sustainable chemical management and enables tangible progress in the wider industry through a number of reference guides, practical tools, capacity building and innovation projects.

More information about ZDHC at www.roadmaptozero.com.

2. Background

In November 2018, the World Health Organization (WHO) hosted the first global conference on air pollution, in collaboration with the UN, and set a 2030 goal to decrease deaths from air pollution by two-thirds (WHO, 2019). In recognition of the importance of air emission control referenced by WHO and following a holistic approach, ZDHC sees the opportunity to broaden its impact and protect both communities and the environment through air emissions management.

The ZDHC Roadmap to Zero (RtZ) Programme initiated a collaborative effort, with representatives across all Stakeholder groups (brands and retailers, facilities, subject matter experts and other third-party organisations) who brought combined expertise on Air Emissions, with the long-term goal to positively impact the industry by establishing a standard approach to air emissions throughout the value chain.

This Position Paper brings together ZDHC contributors and other organisations with the intention of spreading knowledge across the industry, to promote the management

of air emissions through sharing of best practices. It is hoped it will enable future, more quantitative guidelines by influencing the industry to begin increased data gathering for potential air emissions impacts.

To inspire further collaboration and wide-scale acceptance across the industry, the RtZ Programme invites all relevant stakeholder groups to implement this document. The oversight and changes proposed here will allow for improved sustainability having a positive impact for the industry and the planet.

To create this paper, priorities were determined for investigation, based upon preliminary research. This list was established through investigations into which parameters contribute the largest impact to both environmental and human health:

1. World Health Organization (WHO) pollutants (NO_x, PM10, PM2.5, Ozone, SO_x).
2. Globally regulated air pollutants (VOC/TOC, HAPs, CO, Ammonia).
3. ZDHC Manufacturing Restricted Substances List (ZDHC MRSL) parameters.
4. Greenhouse Gases (GHG).

Current efforts to manage air emissions from across the world were brought together and summarised including global regulatory research.

Through combined studies, it was clear that:

A. Like previous work in wastewater, current air emissions regulations are far from requiring zero discharge of hazardous chemicals.
B. There is, not yet, an industry standard for air emissions guidelines across the industry, nor across related Stakeholder groups.

3. Objectives

This document introduces a framework for evaluating air emissions of pollutants generated during facility operations and manufacturing processes at textile, leather, apparel, and footwear facilities. Its aim is to enable ZDHC contributors, and the entire industry, to minimise air pollution. The ambitions are to create an aligned industry approach for air emissions, to establish minimum tracking expectations in order to understand air emissions and to promote industry standardisation of air emissions data. Future revisions of this document as the ZDHC Air Emissions Guideline will establish a standardised cadence and framework to monitor and report results of tracking and performance across the value chain.

With this document, ZDHC aims to:

- Establish required parameters and minimum tracking expected by facilities to ensure that air emissions do not have an adverse impact on communities and the environment.
- Share best practices and recommended limit values for quantitative testing of air pollutants produced by facilities operations and manufacturing.

This document includes limits for Facilities Operations including relevant WHO and Globally Regulated pollutants as noted in Table 1 Appendix A.

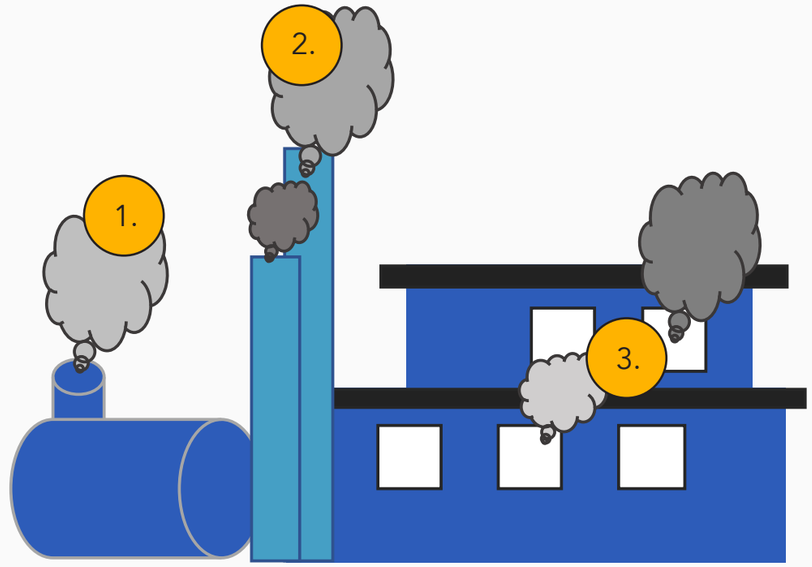
This document includes exposure limits for ZDHC MRSL compounds relevant for air emissions, as noted in Table 2, Appendix A.

4. Scope

This document applies to industrial air emissions discharges produced from facility operations and process operations associated with textile, apparel and footwear suppliers.

For this Position Paper, Facility Operations refers to any sort of combustion or other facilities-based air emissions sources, and Process Operations address production process, production line equipment, and manufacturing processes.

In Scope Emissions	Facility Operations	• Boilers • Generators • Combustion engines • Industrial ovens (for heating/drying/curing) • Combustion heating and Ventilation • Refrigerant-containing Devices • Other sources of known air emissions from facility operations. • Other sources of volatile organic compounds (VOCs)
	Process Operations	• Yarn spinning or synthetic fiber manufacturing • Finishes (mechanical and chemical) • Solvents • Adhesives/cementing • Printing • Dyeing • Tenter frames or other heating processes • Spot cleaners • Sprayed chemicals or paints • Other sources of known air emissions from production processes, such as ozone depleting substances (ODSs).



1. Facility Operations:

- Point Source Emissions
- Energy Generation (i.e. Boilers & Generators)

2. Process Operations:

- Point Source Emissions
- Stack Emissions (i.e. Solvent Exhaust)

3. Process Operations:

- Non-Point Source Emissions
- Fugitive Emissions (i.e. Unexhausted Solvent)

Currently Out of Scope:

- Wastewater Emissions to Air
- Sludge Emissions to Air

Out of scope: Concepts discussed within this Position Paper may be relevant to chemical manufacturing facilities, yet chemical manufacturing as a whole is considered out of scope for the purpose of this document.

5. Facility Operations

Facility operations are important to monitor within the industry due to the significant contribution they have upon the local airshed.

5.1 Facility Operations Scope

To simplify the scope, the key pollutant groups of concern for this type of emission include:

1. World Health Organization (WHO) Pollutants
    a. Nitrous Oxides (NO_X)
    b. Particulate Matter (PM, PM_{10} and $PM_{2.5}$)
    c. Ozone (O_3)
    d. Sulphur Oxides (SO_X)
2. Globally Regulated Air Pollutants
    a. Volatile Organic Compounds (VOC) + Total Organic Carbon (TOC)
    b. Hazardous Air Pollutants + Toxic Air Pollutants (HAP + TAP)
    c. Carbon Monoxide (CO)
    d. Ammonia (NH_3)
3. Greenhouse Gases (GHG)

5.2 Facility Design and Operations

When considering air emissions from a facility, it is essential to understand the facility design and any limitations which may stem from this design. The design of a facility has a significant impact on the ability to properly manage and, if necessary, treat air emissions.

Each facility should manage its air emissions in a responsible manner to minimise air emissions. Below are design and operational considerations which must be addressed.

Opacity	Ensure each facility meets permitted opacity requirements, and that visible particulate emissions from any stack shall not exceed 20 percent opacity, as a 10-minute average, except for a period of 10 consecutive minutes in any 60-minute period.
Stack Heights	Stack heights shall be designed according to local building regulations, and for any new construction, stack heights must meet good engineering practice.
Emissions Segregation	When possible, each type of pollutant shall be segregated from other types of pollutants through proper exhaust management, with examples seen in Appendix D. Likely sources of exhaust include general ventilation, VOC/ solvent ventilation and acid ventilation. When necessary each exhaust source should be treated through appropriate technology such as thermal oxidation, scrubbing, or filtration.
Special Exhaust Ventilation	When concentration of any listed pollutants within this standard exceeds requirements for human health either for OSHA (US), OEL (EU), exhaust ventilation must be used to protect human health. Best practice is to meet ACGIH Threshold Limit Values (TLV) limits. This limit can be achieved through local exhaust ventilation, glove box/exhausted laboratory benches, or through other engineering methods.

5.3 Facility Minimum Expectations

Facilities operate in so many ways, that it is important to establish a foundation of minimum expectations for all who generate air emissions. For this Position Paper, the basic requirements include:

- Quantify and track emissions of all permitted pollutant categories in a manner consistent with standards and best practices of measurement and transparency.
- Regardless of permit or other local standards, quantify and track relevant key pollutant groups.
- Phaseout (Protocol Montreal n.d.) of Class I Ozone Depleting Substances (ODS)[2], and, commit to not installing refrigerants or other equipment using Class II ODS[3].
- Commit to not installing new coal-fired boilers or other sources of coal-fired heat and power generation.[4]

[2] Class I Ozone Depleting Substances
[3] Class II Ozone Depleting Substances
[4] Fashion Charter for Climate Action

- Minimise air emissions impact on human health and the environment.
    - Where human health exposure is a risk, at the very least, meet minimum exposure requirements established by American Conference of Governmental Industrial Hygienists (ACGIH)[5] or Occupational Safety and Health Administration (OSHA)[6] limits.

5.4 Facility Data Tracking Requirements

It is imperative to understand the operations of a facility in order to accurately calculate the air emissions impact. At a minimum, the following must be tracked:

Source	Type
Permits[7]	All pollutants listed within the permit.
	Relevant compliance documentation.
Facilities Operations (including refrigeration)	Equipment inventory.
	Fuel source data.
	Emissions locations and types.
	Treatment method(s) for each point source, if applicable.
	Potential to emit and emissions calculations, plus testing for each point source, if needed

5.4.1 Facilities Equipment Inventory

A list of all facility operations equipment is an essential step towards air emissions calculations. Basic information about the equipment shall be tracked, including type, size, and basic fuel requirements.

[5] American Conference of Governmental Industrial Hygienists

[6] Occupational Safety and Health Administration (OSHA) - EU - USA

[7] ZDHC will not request, verify, or collect information related to permits, relevant compliance documentation, or related information.

5.4.2 Fuel Source Data

Fuel source data is important to understand as it drives the types and quantities of pollutants as well as the efficiency of combustion. For each piece of equipment, and over time, fuel source data should be logged by type, quality, and, quantity used.

5.4.3 Facilities Emissions Locations and Type

Facilities operations may have both point and non-point sources of air emissions. It is valuable to track the location of known point sources (such as exhaust vents) so that each emissions point may be calculated or monitored for emissions. Non-point sources (such as dust from roads) must also be tracked so that emissions estimates can be made. For each point and non-point source, site experts shall analyse the risks of air pollutants, with special attention upon the key pollutant types listed in 5.1.

5.4.4 Treatment Methods

Facility operations include treatment methods for the equipment of the facility as well as treatment methods applied to process emissions. Air emissions treatment systems shall be tracked (such as scrubbers or thermal oxidisers), their fuel sources monitored if applicable, and their operational parameters documented.

Facilities must properly manage solid and liquid waste from air emissions treatment systems at a licensed or permitted waste disposal facility or through wastewater management in adherence with the ZDHC Wastewater Guideline.

5.5 Facilities Emissions Calculation

It is the responsibility of those who best know the facility to track any of the key pollutant groups of concern. However, for facility operations, the greatest impact is most likely to come from the WHO Pollutants. Therefore, at minimum, a facility shall calculate PTE, or if possible, other emissions calculations for the following key pollutant groups:

Required PTE or Emissions Calculations		
Source	**Pollutant**	**Best Practice**
Combustion	NO_X	Choose the appropriate emission factor for each fuel type.
	CO	
	SO_X	
	PM	
	GHG	

- Estimation or testing shall be conducted, at minimum, on an annual basis. When changes are implemented in a facility which impact air emissions, estimation or testing shall be repeated.

Global regulatory standards and third-party consultants were referenced to establish baseline expectations for emissions levels from some important facilities equipment.

- Refer to Appendix A Table 1 for the proposed levels (foundational, progressive and aspirational) of this Position Paper.
- Where human health exposure is a risk, at the very least, meet minimum exposure of ACGIH/OSHA limits, with special consideration for those that are ZDHC MRSL pollutants, as summarised in Appendix A Table 2.

5.6 Facilities Emissions Testing

All facilities should develop written procedures that clearly identify and document the sampling point(s), sampling methodologies and reporting frequency for the following sampling types:

Point Source Facilities Emissions

- Use of emissions factors for presumptive emissions is a preferred calculation method where in-house or third-party testing and related assumptions are documented and maintained during operation.
- If abatement is completed, air emissions sampling should occur annually following standard test protocols for all relevant sources, unless documented Destruction Removal Efficiency (DRE) data is available for chosen treatment method. If DRE data is available, testing is needed only once every five years. Regular maintenance of treatment equipment is required and documented annually.

Non-Point Source Facilities Emissions

- Emissions testing is not needed, but emissions calculations shall be completed.

Point Source Emissions Derived from Process
(More details may be found in Process Operations)

- Air emissions point sources may come from multiple exhaust streams or treatment technologies. Each discharge location shall act as its own sampling point, and sampling shall occur independently at each sampling point as specified in this document.
- When sampling multiple streams, each air emissions sample shall be tested independently of the others; samples from multiple discharge points must be tested separately and not blended.
- All air emissions points of reportable limits shall be of the same quality as that which is finally released to the atmosphere.
- Quantification of emissions or DRE may require upstream testing from the final emissions point to the atmosphere to complete calculation. These samples shall not be compared to the set limits in this document, as the last one focuses solely on atmospheric emissions.
- Air emissions shall not be altered after the ultimate atmospheric testing point.

5.7 Facilities Sampling Methodology

Proper sampling procedure and technique is essential to ensure high quality and usable air emissions testing. Therefore, the following considerations must be made:

- Depending upon the type of testing, samples shall be collected according to most relevant test methods, including locations needed for sampling ports, traverse, etc.
- Samples shall be taken by qualified personnel. Laboratories performing sample collection must maintain a chain-of-custody log for each sample collected to ensure the integrity of the sample.
- Under no circumstances shall samples be taken during times when the production process is not running or the air emissions are not representative of normal operations (i.e. dust storm, etc.)
- For facilities with blended exhaust streams, samples may need to be taken before co-mingling occurs to quantify inlet concentrations to treatment systems or to accurately measure pollutants prior to dilution.

Industrial Hygiene

To protect human health from air emissions, the following steps shall be taken:

- Human exposure testing shall be completed, at minimum, if odours are detected, and annual PID (photoionization detector) or other relevant area sampling technique (such as FTIR or GC) is recommended in all process areas if known exposure potential, regardless of odour.
- For specific compound analysis, if applicable, appropriate personal or area sampling is conducted following best practices of industrial hygiene.
- If emissions calculations or test reports show limit exceedance for a given parameter, or exceeds a legal permit limit, facilities are expected to:
    a. Notify the applicable authorities of any permit violations, as well as notify the ZDHC brand(s) and/or other customers;
    b. Submit a corrective action plan with a defined completion date.

6. Process Operations

Process operations are inextricably linked with the manufacturing done at a facility, and may have an impact upon air emissions, depending upon chemistry and processes.

6.1 Process Operations Scope

To simplify the scope, the key pollutant groups of concern for this type of emission include:

1. World Health Organization (WHO) Pollutants
    a. Nitrous Oxides (NO_X)
    b. Particulate Matter (PM, PM_{10} and $PM_{2.5}$)
    c. Ozone (O_3)
    d. Sulphur Oxides (SO_X)
2. Globally Regulated Air Pollutants
    a. Volatile Organic Compounds (VOC) + Total Organic Carbon (TOC)
    b. Hazardous Air Pollutants + Toxic Air Pollutants (HAP + TAP)
    c. Carbon Monoxide (CO)
    d. Ammonia (NH_3)
3. ZDHC Manufacturing Restricted Substances List (ZDHC MRSL) parameters.
4. Greenhouse Gases (GHG)

6.2 Process Minimum Expectations

Types of process operations are vast, so it is important to establish a foundation of minimum expectations for all who generate air emissions. For this Position Paper, the basic requirements include:

- Quantify and track emissions of all permitted pollutant categories in a manner consistent with standards and best practices of measurement and transparency.
- Regardless of permit or other local standards, quantify and track relevant key pollutant groups.
- Phaseout (Protocol Montreal n.d.) of Class I Ozone Depleting Substances (ODS)[8], and, commit to not installing refrigerants or other equipment using Class II ODS[9].

[8] Class I Ozone Depleting Substances
[9] Class II Ozone Depleting Substances

- Minimise air emissions impact on human health and the environment.
    - Where human health exposure is a risk, at the very least, meet minimum exposure requirements established by American Conference of Governmental Industrial Hygienists (ACGIH)[10] or Occupational Safety and Health Administration (OSHA)[11] limits.

6.3 Process Data Tracking Requirements

It is imperative to understand the process operations to accurately calculate the air emissions impact. At a minimum, the following must be tracked:

Source	Type
Permits [12]	All pollutants listed within the permit.
	Relevant compliance documentation.
Process Operations	Chemical inventory.
	PTE For Each Pollutant Group and, if needed, emissions calculations.
	Tool and process inventory.
	Local treatment or exhaust connections.
	Process emissions testing, if applicable.
	Industrial hygiene sampling, if applicable.

[10] American Conference of Governmental Industrial Hygienists

[11] Occupational Safety and Health Administration (OSHA) - EU - USA

[12] ZDHC will not request, verify, or collect information related to permits, relevant compliance documentation, or related information.

6.3.1 Chemical Inventory

A chemical inventory is needed to understand the potential impact of chemicals to contribute to air emissions. Please refer to the ZDHC Chemical Management System - Framework (ZDHC CMS) guidance for more specific information about Chemical Inventory Lists (CIL). Classification of chemicals within the key pollutant groups is important, and Appendix C may be used to support this work.

6.3.2 Potential to Emit (PTE) and Emissions Calculations

To estimate the overall impact of the chemistries used onsite, calculate the potential to emit:

- If the PTE for any key pollutant group exceeds five tons per year (TPY), an emissions calculation and/or testing shall be completed to prove proper management of this pollutant.

Utilise appropriate process-specific knowledge, tool and process inventories, and any relevant emissions factors to calculate emissions. Mass balance may be used, with a simple guide available in Appendix C.

6.3.3 Tool and Process Inventory

A list of all tools, or machines which use or are maintained with chemicals, and information about the associated processes shall be kept in the form of an inventory. Relevant information, including process steps, heat application, chemicals mixing, or any other information needed to calculate impact to air emissions shall be included as part of this tracking.

6.3.4 Local Treatment and Exhaust Connections

Sometimes, filters, scrubbers or some other form of local treatment may be applied at a tool or within processing. This information shall be documented, and any exhaust connections shall be noted as well.

6.4 Process Emissions Calculation

As process experts, it is the responsibility of the team to track any key pollutant groups of concern. However, for process operations, the likely greatest impact will come from the Globally Regulated and ZDHC Pollutants. Therefore, at minimum, a facility shall calculate PTE, or if possible, other emissions calculations for the following key pollutant groups:

Required PTE or Emissions Calculations		
Source	**Pollutant**	**Best Practice**
Process	VOC	For PTE, assume 100% of chemicals are emitted. Then, if EFs are available, use known values.
	HAP	
	Ammonia	
	O_3	

- Where human health exposure is a risk, at the very least, meet minimum exposure of ACGIH/OSHA limits, with special consideration for those that are ZDHC MRSL pollutants, as summarised in Appendix A Table 2.

6.5 Process Emissions Testing

Point Source Process Emissions

- Air emissions point sources may come from multiple machines or tools. Each discharge location shall act as its own sampling point, and sampling shall occur independently at each sampling point as specified in this document.
- When sampling multiple streams, each air emissions sample shall be tested independently of the others; samples from multiple discharge points must be tested separately and not blended.
- Additional sampling may be needed at treatment or the outlet to the atmosphere, which is covered in Facilities Operations testing.

Non-Point Source Process Emissions

- Emissions testing is not needed, but emissions calculations shall be completed.
- For any pollutants classified as Volatile Organic Compound (VOC) or Hazardous Air Pollutant (HAP) but that are not part of the ZDHC MRSL, it is expected that facilities complete:

  - Mass balance calculations to prove no risk to human health.

    Or
  - Annual testing for each potential exposure type or area to prove no exceedance.
- It is expected that substances on the ZDHC MRSL are not used intentionally within the facility.
- If any calculations or human health testing shows high quantities of chemical emissions, best practices necessitate the installation of exhaust system and may require treatment.

6.6 Process Emissions Sampling Methodology

Proper sampling procedure and technique is essential to ensure high quality and usable air emissions testing. Therefore, the following considerations must be made:

- Depending upon the type of testing, samples shall be collected according to most relevant test methods, including locations needed for sampling ports, traverse, etc.
- Samples shall be taken by qualified personnel. Laboratories performing sample collection must maintain a chain-of-custody log for each sample collected to ensure the integrity of the sample.
- In no circumstance shall samples be taken during times when the production process is not running or the air emissions are not representative of normal operations (i.e. dust storm, etc.)

Industrial Hygiene

To protect human health from air emissions, the following steps shall be taken:

- Human exposure testing shall be completed, at minimum, if odours are detected, and annual PID (photoionization detector) or other relevant area sampling technique (such as FTIR or GC) is recommended in all process areas if known exposure potential, regardless of odour.
- If emissions calculations or test reports show limit exceedance for a given parameter, or exceeds a legal permit limit, facilities are expected to:
  a. Notify the applicable authorities of any permit violations, as well as notify the ZDHC brand(s) and/or other customers;
  b. Submit a corrective action plan with a defined completion date for the resolution of the excursion.

7. Best Practices

Global best practices for both facilities and process operations can be found in Appendix B.

Appendix A

Table 1. Facility Operations - Equipment/Combustion. Parameters and Limit values for facilities - WHO and Globally Regulated Pollutants

Source	Parameter	Fuel Type	Foundational	Progressive	Aspirational	Concentration Units
Facility Combustion	NO_x	Solid	650	300	200	mg/Nm^3
Facility Combustion	NO_x	Liquid	460	250	85	mg/Nm^3
Facility Combustion	NO_x	Gas	400	150	40	mg/Nm^3
Facility Combustion	CO	Solid	800	500	100	mg/Nm^3
Facility Combustion	CO	Liquid	650	400	100	mg/Nm^3
Facility Combustion	CO	Gas	500	300	100	mg/Nm^3
Facility Combustion	SO_x	Solid	750	650	300	mg/Nm^3
Facility Combustion	SO_x	Liquid	600	450	300	mg/Nm^3
Facility Combustion	SO_x	Gas	400	300	100	mg/Nm^3
Facility Combustion	PM	Solid	500	300	100	mg/Nm^3
Facility Combustion	PM	Liquid	300	100	50	mg/Nm^3
Facility Combustion	PM	Gas	100	50	20	mg/Nm^3

Out of scope: *Non-Production Related Facilities (i.e. Office Buildings), <2MW Sizing; < 500hr/yr*

Table 2. Process Operations: Human Exposure Limit Values for MRSL Pollutants

Please note: Limit values documented here are not established or maintained by ZDHC, the minimum human exposure limits for ZDHC MRSL parameters were compared with those of ACGIH, US OSHA, and EU OSHA, and are shared for simple reference.

CAS	Parameter	Limit	Units
	Chlorobenzenes		
95-50-1	1,2dichlorobenzene (1,2-DCB)	20	ppm
	Glycols		
111-96-6	Bis(2methoxyethyl)ether	5	ppm
110-80-5	2-ethoxyethanol	2	ppm
111-15-9	2-ethoxyethyl acetate	2	ppm
110-71-4	Ethylene glycol dimethyl ether	5	ppm
109-86-4	2-methoxyethanol	0.1	ppm
110-49-6	2-methoxyethylacetate	0.1	ppm

CAS	Parameter	Limit	Units
Glycols (continued)			
70657-70-4	2methoxypropylacetate	5	ppm
112-49-2	Triethylene glycol dimethyl ether	5	ppm
Halogenated Solvents			
107-06-2	1,2-dichloroethane	10	ppm
75-09-2	Methylene chloride	50	ppm
79-01-6	Trichloroethylene	10	ppm
127-18-4	Tetrachloroethylene	20	ppm
Volatile Organic Compounds (VOC)			
71-43-2	Benzene	0.5	ppm
1330-20-7	Xylene	50	ppm
95-48-7	o-cresol	20	mg/Nm^3
106-44-5	p-cresol	20	mg/Nm^3
108-39-4	m-cresol	20	mg/Nm^3

Appendix B

Recommended process Best Practices[13]

Specific best practices for treatment systems can be found through documented local or global analysis of treatment methods, which may include Best Available Technology (BAT), Lowest Achievable Emissions Rate (LAER), or other relevant air emissions treatment analysis.

Process		
Type	Operations	Best Practice (Percentage Reduction Based on PTE Calculation or Inlet to Treatment Equipment, as appropriate)
VOC	Coating	Reduce VOC usage by 90% or control equipment at DRE = 90%
HAP/TAP	Leather	Meet Leather NESHAP Table 1
HAP/TAP	Printing, Coating & Dyeing	Reduce HAP by 98%, or limit emissions to 0.08 kg HAP/kg solids
HAP/TAP	Dyeing	HAP emissions <0.016 kg/kg dye
HAP/TAP	Finishing	HAP emissions <0.0003 kg/kg finishing materials
O_3	Bleaching	Reconvert O_3 to O_2 prior to environmental release
Ammonia	Printing	Keep release <30 mg/m^3 and ensure no odor emissions Ensure short term <35ppm during any 15-minute period; <25ppm over 8-hour workday.

[13] Sources:

a. Definition of Best Available Techniques (BAT) in Europe: BAT for Air Emission Reduction in the Chemical Industry Sector in Germany

b. Best Available Techniques Reference Document on the Textiles Industry

Appendix C

Potential to Emit (PTE) and Pollutant Classification[14]

For emissions calculations, at minimum, the following pollutants should be calculated through PTE, or emissions calculations:

Required PTE or Emissions Calculations		
Source	**Pollutant**	**Best Practice**
Combustion	NO_X	Choose the appropriate emission factor for each fuel type.
	CO	
	SO_X	
	PM	
	GHG	
Process	VOC	For PTE, assume 100% of chemicals are emitted. Then, if EFs are available, use known values.
	HAP	
	Ammonia	
	O_3	

To determine if a chemical is a Hazardous Air Pollutant, Toxic Air Pollutant[15] or CMR[16], please refer to applicable government lists.

To determine if a chemical is a volatile organic compound (VOC) or, if applicable, should be tracked as total organic carbon, please follow the steps below:

Required VOC Classification	
1	Contains carbon.
2	Vapor Pressure >= 0.01 kPa (~0.075 mmHg) at 293.15K
3	Boiling point <=250C at standard pressure of 101.3 kPa

Required VOC Classification	
1	Consider MW of Compound.
2	Convert Total VOC to TOC by multiplying by: (MW Carbon/Total MW)

[14] US-EPA Hazardous Air Pollutants List

[15] Stationary Pollution Source Air Pollutant Emissions Standards

[16] Europe | New limits for 33 CMR substances in clothing, textiles and footwear under REACH

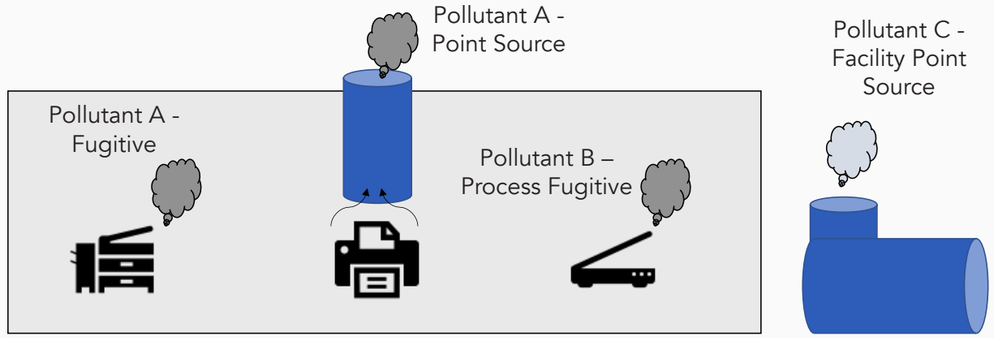
If a mass balance is chosen to track air emissions, please consider the following steps:

Mass Balance Calculation	
1	Review robust chemical inventory.
2	Classify all chemicals, especially if VOC, HAP, Ammonia, O_3.
3	Summarise potential emission if 100% of chemicals were emitted to air.
4	If any additional information/assumptions are available (including AP-42, or other emissions testing or DRE values), re-calculate projected emissions to air.
5	If potential for human exposure, then consider PPE, or other relevant aids, and re-analyse for exposure.

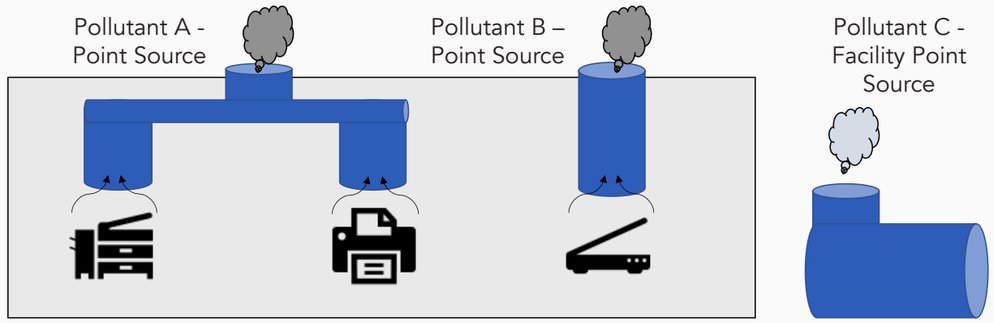
Appendix D

Air Emissions Segregation - Visualisations

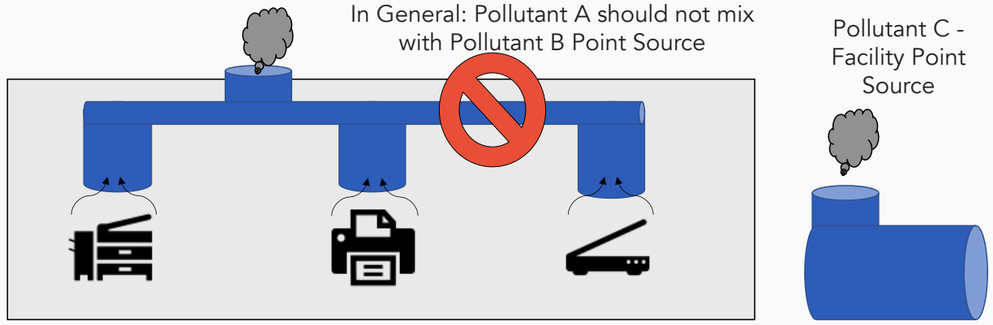
Current state at facility:



Proper segregation may combine sources of Pollutant A & direct emissions out of facility.



In general, different pollutant streams should remain segregated



References

World Health Organization. (2019). *Air Pollution*. Retrieved from World Health Organization: https://www.who.int/airpollution/en/

World Health Organization. (2019). *First WHO Global Conference on Air Pollution and Health, 20 October - 1 November 2018*. Retrieved from World Health Organization: https://www.who.int/airpollution/events/conference/en/