THE ODOUR UNIT

TECHNICAL MEMORANDUM

**TO:** KAYLA GREGG
**COMPANY:** PAINTBACK PTY LTD C/O DAVIS ADVISORY
**FROM:** MICHAEL ASSAL
**DATE:** 12 SEPTEMBER 2023
**JOB NO:** N2348
**SUBJECT:** PROPOSED PAINT RECOVERY FACILITY – 2-44 GRAINGERS ROAD, WEST FOOTSCRAY, VICTORIA - ODOUR MANAGEMENT ASSESSMENT (REVISION 3)

## 1. Introduction

In August 2023, The Odour Unit (**TOU**) was engaged by Davis Advisory on behalf of Paintback Pty Ltd (**Paintback**) to undertake an odour management assessment (**OMA Study**) in relation to the proposed paint recovery facility, known as the 'Paint Circular Economy Headquarters', to be housed within a building on the existing Wattyl Paints site located at 2-44 Graingers Road, West Footscray, Victoria (**PaCE HQ**). The following memorandum documents the outcomes of the OMA Study for PaCE HQ.

## 2. Relevant Background and Context

In preparing the OMA Study, TOU has relied upon the following documentation supplied by Davis Advisory on behalf of Paintback:

- A report prepared by Argon&Co titled *Process Flow Diagram and Best Practice Analysis Report Version 1.0* dated November 2022 (**Argon&Co November 2022 Report**);
- A report prepared by SLR Consulting Australia Pty Ltd titled *Odour Assessment - Project Transformer 2-44 Graingers Road, West Footscray - SLR Ref: 640.30545-R01 Version No: -v2.1* dated 17 March 2023 (**SLR Report**);
- A simplified layout prepared by Argon&Co of PaCE HQ and supplied to TOU on 16 August 2023;
- A piping and instrumentation diagram labelled as Revision 4, prepared by Argon&Co and supplied to TOU on 22 August 2023 (**P&ID**);
- A conceptual layout of the proposed airflow configuration for the process area at PaCE HQ prepared by Argon&Co and supplied to TOU on 17 July 2023; and
- A series of information-gathering meetings conducted with Davis Advisory, Argon&Co, and Paintback.

In preparing the OMA Study, TOU notes the following:

- Prior to engagement, a good degree of information had been generated surrounding the activities at PaCE HQ. Therefore, the OMA Study seeks to consolidate the various information sources to ensure information symmetry and clarity surrounding the proposed paint recycling operations. This process enabled a reasonable technical understanding of the odour risks associated with PaCE HQ that can be used as a basis for risk reduction and management measures; and
- A clear pathway to achieve the outcomes documented in the SLR Report that the odour risk posed by PaCE HQ will be low. The OMA Study builds on the odour assessment process conducted in the SLR Report, with a focus on:
    - The operational activities and their related odour emission risk points; and

- A conceptual engineering design and review of all reasonable and practicable measures that can be incorporated into the operations to minimise odour risk on the receiving environment and achieve a low impact risk.

Where necessary, information obtained from the various referenced sources are incorporated into the OMA Study. This is to ensure that the OMA Study could be examined and reviewed as a stand-alone report to ensure clarity of the latest information relied upon surrounding the proposed operations at PaCE HQ and facilitate a streamlined understanding of the documented odour emissions and management outcomes.

## 2.1 OMA Study Approach

The approach for the OMA Study of PaCE HQ consists of the following:

- A review of the proposed operations and building ventilation and process air management system;
- Engineering design input surrounding the engineered controls to adequately manage odour emissions from the water and solvent process lines. This includes design input of the building ventilation air extraction management system and the requirement for emissions control equipment, where required; and
- The assignment of appropriate/expected performance targets surrounding the metrics for success from an odour management perspective (where applicable).

Furthermore, the OMA Study has given due consideration to the Environment Protection Act 2017 (the **Act**) that took effect on 1 July 2021 and introduces a general environmental duty (**GED**), which requires everyone, including businesses and individuals, conducting activities that pose a risk to human health or the environment from pollution or waste to understand those risks and take reasonably practicable steps to eliminate or minimise them. The intention of the GED is that a risk-based approach to minimise risk of harm (and/or nuisance), rather than compliance with defined standards, should be pursued.

Under the Act, the Environment Reference Standard (**ERS**) is used to assess and report on environmental conditions in the whole or any part of Victoria. It sets out indicators and objectives for the ambient air environment and includes an odour environmental quality objective:

- *An air environment that is free from offensive odours from commercial, industrial, trade and domestic activities*.

The OMA Study seeks to provide the necessary information and expert advice on how this odour environmental quality objective can be achieved at PaCE HQ.

# 3. Site Locality and Context

As documented in the SLR Report, PaCE HQ will be adjacent to the existing Wattyl Paints site and surrounding land is zoned Industrial 1 Zone (IN1Z) and Industrial 3 Zone (IN3Z) with General Residential 1 Zone (GR1Z) to the south and Mixed-Use Zone and Neighbourhood Residential Zone to the southwest. In summary, the surrounding land-use of PaCE HQ is as follows:

- The immediate surrounding land is Industrial 1 Zone (IN1Z) and Industrial 3 Zone (IN3Z);
- General Residential 1 Zone (GR1Z) to the south;
- To the West is both IN3Z and GR1Z, with the majority of the land being predominately residential; and
- directly to the East is IN1Z, with there being additional land nearby which falls under the Mixed-Use Zone (MUZ).

The site locality and context are shown in **Figure 1** and **Figure 2**.

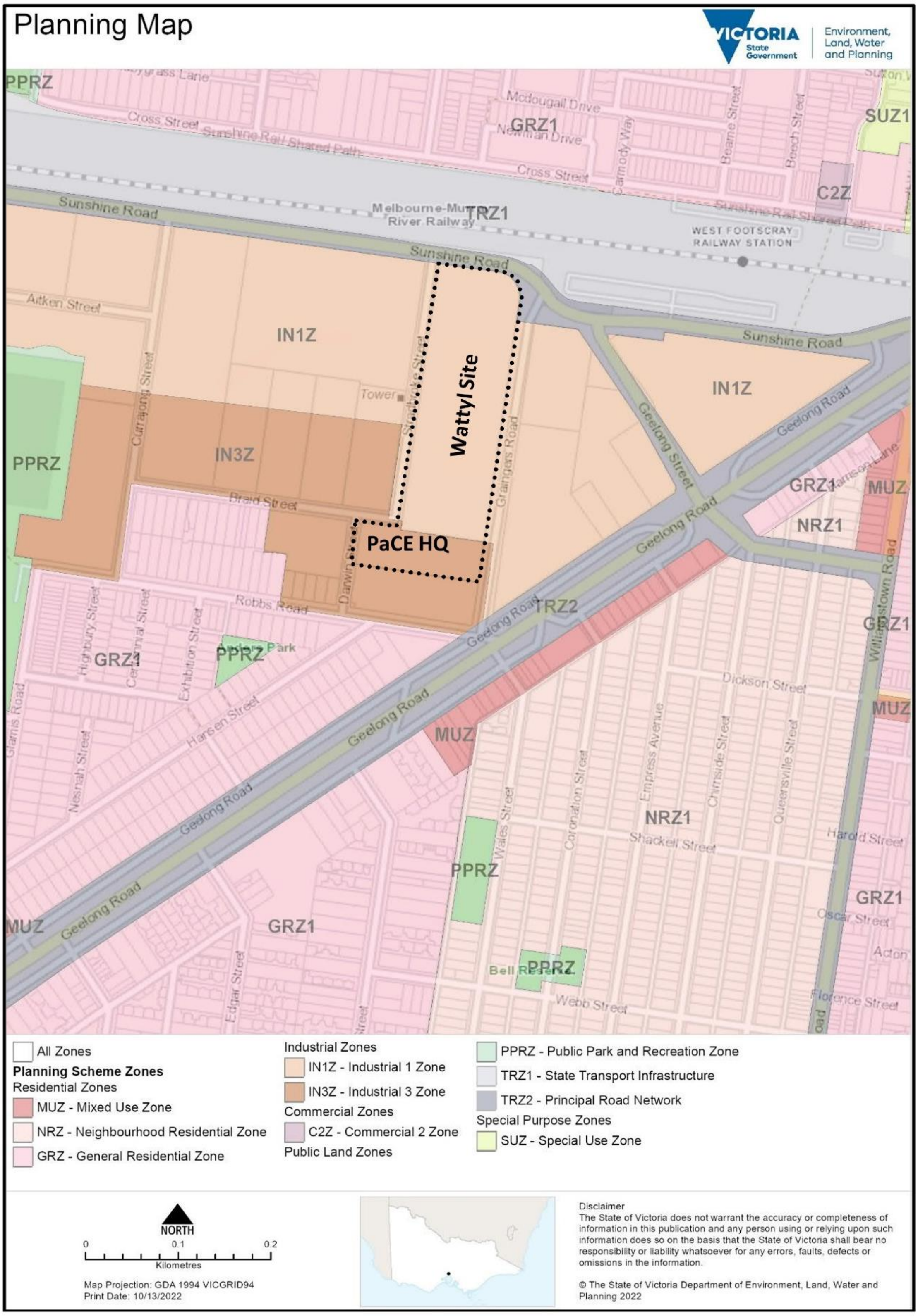


**Figure 1** – The surrounding land-use zoning to PaCE HQ (**Source**: SLR Report)


**Figure 2** – An aerial map illustrating the locality and context of \ PaCE HQ (**Source** SLR Report)

## 4. Process Operations Overview

A site layout of PaCE HQ is shown in **Figure 3**. The proposed process operations at PaCE HQ will consist of the receipt, sorting, separation, and materials recovery of mixed domestic and trade paint cans into recovered paint and reusable materials such as metal and plastic. It will also include a research and innovation facility focused on developing higher-value applications for the reusable paint materials. TOU understands that PaCE HQ will be an 'Australian first' plant capable of aggregating, sorting, separating liquid from its packaging, blending water-based paint for higher resource recovery, delivering solvent-based paint for waste-to-energy applications and cleaning and re-sizing packaging for effective recycling - all in a single integrated facility.

As outlined in **Section 1**, PaCE HQ will be housed in an existing and dedicated building, as shown in **Figure 2**. The operations of PaCE HQ will operate discretely from the existing Wattyl Paints activities. The general hours of operation will be between 0700 hrs and 1800 hrs, with standard operational hours between 0700 hrs and 1500 hrs, Monday to Saturday. On average, there are expected to be 4-5 inbound deliveries per day and 3-4 outbound distributions per day. These interactions will also occur within the general hours of operation. Furthermore, the anticipated protocol within these hours of operation will include solvent and water-based paint processing of metal containers and a single day for water-based paint processing of plastic containers.

TOU notes water-based paints are contained in either plastic or metal containers, as is convention for paint product sales and distribution in the retail and commercial markets. Solvent-based paint is in metal containers only.

PaCE HQ will have storage capacity for 1.5 days' worth of inbound material as well as sufficient storage for 1.5 days' worth of outbound product. However, the intention is to dispatch to customers as soon as a truck's worth of product has been produced. As outlined in the Argon&Co November 2022 Report, on a mass basis, the throughput and storage capacities will be 10,596,500 L of processed material flow per year, with planned production days per year of 250 L. This is equivalent to a planned raw material throughput of 42,386 L per day (approximate values are quoted). Based on this understanding, a detailed operational process description and odour analysis is provided in **Section 4.2**.

## 4.1 Operational Process Description and Analysis

As outlined in the Argon&Co November 2022 Report, PaCE HQ will involve the collection of several established technologies in the recycling of metal and plastic containers and paint liquid extractions and establishes them inline under an integrated operation in a single dedicated building that can handle the circular process of recycling used paint from collection through to scrap metal, granulated plastic and extracted paint. As articulated in the SLR Report, the unit of operations at PaCE HQ can be summarised as follows:

- Delivery of inbound stillages filled with various containers of both solvent and water-based paint;
- Stillages will be stored in a bunded laydown area before being taken to the processing area by forklift;
- The containers will be sorted into either water-based or solvent-based products;
- For **water-based** paint containers:
  - Paint will be removed from the containers using a screw auger (RUNI, as shown in **Figure 3**) deconstructing and compacting the metal and plastic containers;
  - Paint will be captured in intermediate bulk containers (**IBCs**) prior to being standardised and being shipped off site to specific customers for reuse as an ingredient in other products;
  - Compressed plastic containers will be shredded, washed, and bagged; and
  - Compressed metal containers will be shredded and washed to 50 mm strips. The shredded and washed strips will be transferred to an industrial bin and sent for metal recycling.
- For **solvent-based** paint containers:
  - Paints will be transferred to a building area where the metal containers with be compressed with an International Electrotechnical Commission Explosive (**IECEx**) rated screw auger; and
  - Paint will be collected in IBCs, and the compressed metal containers will be transferred to perforated stillages for passive drying prior to external distribution for metal recycling.

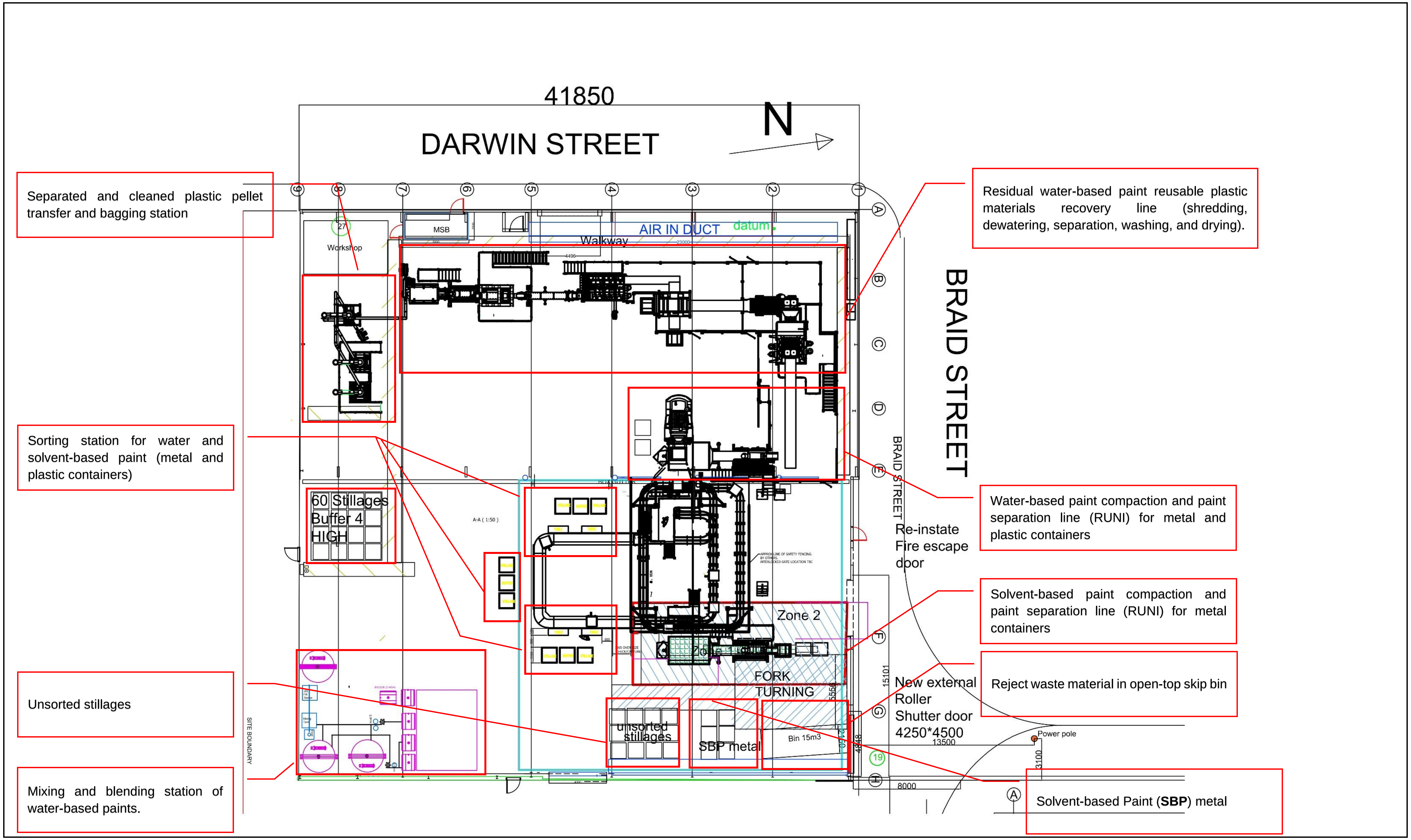


**Figure 3 –** A conceptual process overview of the operations at PaCE HQ (**Acknowledgement**: Argon&Co)

## 4.2 Operational Odour Analysis and Emissions Characterisation

### 4.2.1 Preface

A detailed operational odour analysis of the activities at PaCE HQ is intended to assist in conducting an odour risk identification and characterisation of all potential sources of odour to facilitate the development of site-specific and compatible odour reduction measures and management protocols to anticipate and attenuate future off-site impact under all foreseeable operating conditions. This philosophy is overlaid by the principle and framework offered by the best available technology economically achievable (**BATEA**), representing the best existing performance of treatment technologies economically achievable within an industrial point source category, activity, or environment. As such, an operational odour analysis has been carried out as part of the OMA to provide details on the operations and likely odour emission sources at PaCE HQ, and the management of those odour emissions to mitigate odour impact risk. This is consistent with the guidance contained in the Environment Protection Authority Victoria (**EPA VIC**) *Publication 1517.1 – Demonstrating Best Practice* dated October 2017.

### 4.2.2 Process Overview

A process flow diagram (**PFD**) of the proposed unit of operations at PaCE HQ is illustrated in **Figure 4**.

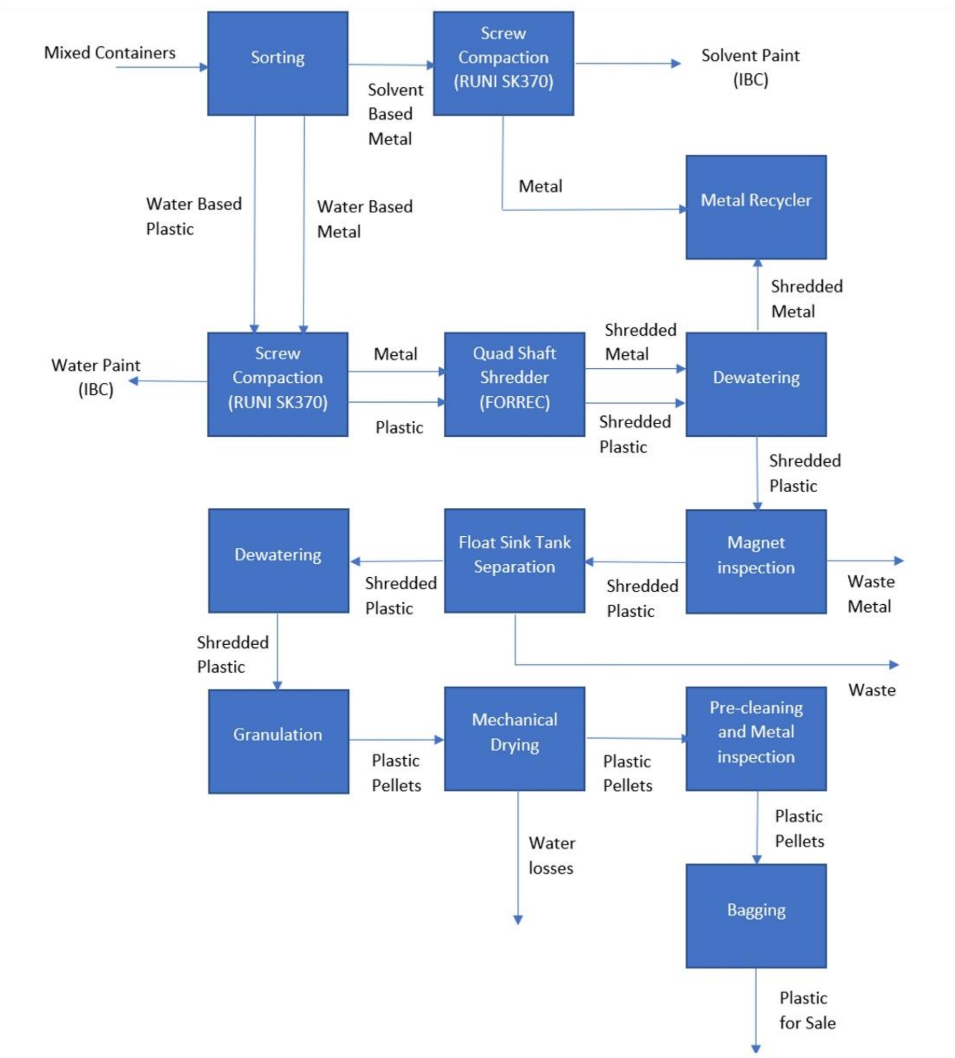


**Figure 4** – A PFD of the paint recycling and reusable materials recovery at PaCE HQ (**Source**: Argon&Co November 2022 Report)

Based on the PFD and the various referenced information sources, the unit of operations can be categorised into six (6) key process steps:

- **Process Step 1** – Delivery, receipt, and buffer storage of metal and plastic paint containers. The delivery of metal and plastic paint containers to PaCE HQ will be either semi-trailer carrying 44 stillages or rigid carrying 24 stillages. There will be inbound storage space for 250 stillages, with the capability to hold stillages at an inbound consolidation centre, with delivery to PaCE HQ as required. The outbound storage will be equivalent to 138 pallet spaces.

- **Process Step 2** – Manual sorting of mixed containers. The inbound stillages of solvent and water-based paint in plastic and metal containers will be sorted manually and fed onto a conveyor, based on their material of construction (plastic/metal) and contents (solvent/water-based paint). Any foreign objects and materials (by-catch) will be removed at this point and stored securely in appropriate cabinets. The sorting will be completed by trained and experienced operators to optimise the separation of metal or plastic containers.

- **Process Step 3** – The screw compaction of metal and plastic paint containers. The sorted containers will be fed via conveyor into either one of the two depackaging processors, as follows:

    1. **Process Step 3A** – Separation of paint and metal for the primary recovery of solvent-based paint in IBCs; and

    2. **Process Step 3B** – Separation of paint and plastic/metal for the primary recovery of water-based paint in IBCs and reusable plastic/metal materials.

  As indicated in Process Step 3A and Process Step 3B, there will be a dedicated water-based or solvent-based IECEx rated large diameter feeding auger and screw compactors (SK730 RUNI), where the container material will be compressed, and the extruded paint collected into IBCs. The metal containers containing solvent-based paint will be transferred via a conveyor to perforated stillage for passive drying (refer to SBP metal in **Figure 3**). The compressed and dried metal container stillages will subsequently be externally distributed to a licensed metal recycler. The water-based containers (both plastic and metal) will be processed through a further washing plant to refine them to a recycling condition (refer to Process Step 4).

- **Process Step 4** – Further processing of metal and plastic containers and secondary water-based paint recovery. As shown in **Figure 4**, the water-based plastic and metal containers will undergo further processing. The initial step involves particle size reduction and washing via a FORREC quad shaft shredder into 50 mm pieces before flowing onto two FORREC vibration screens to remove any excess water (dewatering). At this stage, the shredded metal packaging will be collected and stored in an industrial bin. This will undergo external distribution to a licensed metal recycler. The plastic will undergo further processing as follows:

    1. The dewatered plastics will pass through a magnet inspection step, with waste material sent for disposal;

    2. The shredded plastic pieces will pass through a float sink tank, where the plastic material will float to the surface, while any dry paint, metal or other material will sink to the bottom. A sink float tank will be designed to separate various types of plastic containers by density. The wastewater will flow into a buffer sump pit, with separated solids captured in a basket and sent for disposal;

    3. The next stage will pass the plastic through a wash granulator, where it will be washed at high pressure and processed to 8-10 mm pieces before it undergoes further high-pressure washing in a friction washer to remove any remaining paint material. Once fully cleaned, the plastic will be mechanically dried (spin dryer) and blown across to a twin bagging station to be packed into 1-tonne bags ready for sale as 8-10 mm plastic product. The wastewater will be recycled and managed via Process Step 5; and

4. The water-based paint will be collected into IBCs beneath the screw compactor before being transferred via forklift to the blending plant.

- **Process Step 5 –** Storage of recovered materials, recovered metal, and blended water and solvent-based paint streams, as follows:

  1. **Process Step 5A -** Downstream of Process Step 4, the recovered water-based paint will be blended and processed to a specific solid content to meet customer requirements, and biocide will be added to treat existing microbes and prevent future biological growth and fouling of the paint - this step will extend shelf life of the recovered water-based paint product. The finished water-based product will be stored in IBCs and transferred to the internal storage warehouse prior to dispatch; and

  2. **Process Step 5B –** The solvent-based paint will be collected in IBC's and transferred to the internal storage warehouse via forklift. The solvent-based paint will be used as an alternative fuel in cement kilns or undergo thermal destruction.

- **Process Step 6** – Solid waste and wastewater recovery and management. PaCE HQ will utilise a wastewater circulation process to facilitate the management of wastewater generated from the water-based paint and plastic recovery process. The PFD for the wastewater treatment process is detailed in Figure 5. The wastewater circuit will involve a four-stage process, namely:

  1. **Collection of wastewater streams**: All wastewater from the process will flow to two collection pits to be pumped to either one of two water circulation tanks. Both these tanks will have a level transmitter to measure the wastewater levels in the tank and control the feedwater from either the rainwater tank to the clean water circuit, or from the clean water circulation tank to the dirty water circuit.

  2. **Screening and balancing**: The unprocessed wastewater will enter the pit through a manual screen via gravity to the circulation tank via the inlet screening system. The screened wastewater will be recycled to the equipment on either the dirty or clean water circuit.

  3. **Blending**: The dirty water circuit (T04) will be transferred at the end of each day to a storage tank for blending. At this point, the solids content, pH and viscosity will be analysed to determine the appropriate ratio for blending into the finished paint product.

  4. **Reuse and disposal**: As dirty water from T04 moves out of the system, water moves through the system from T02 to T04 to replace it as T02 is topped up with rainwater. This allows for multiple water passes through the wash plant before exiting the system and removes the need to discharge water to trade waste. Any discharge that does occur to the sewer will be measured using an electromagnetic flow meter.

The entire paint and reusable materials recovery and recycling process will occur at atmospheric temperature and pressure to minimise safety risks and simplify operation. TOU understands that the equipment has been selected following extensive research in Europe to ensure that the process is optimised for maximum extraction of metal, paint, and plastic as well as minimal use of water. The equipment has also been selected for durability and with the capability to increase capacity as the recycling culture in Australia increases, and further demand is required. At peak conditions, a total of 12 operators will support the operations at PaCE HQ

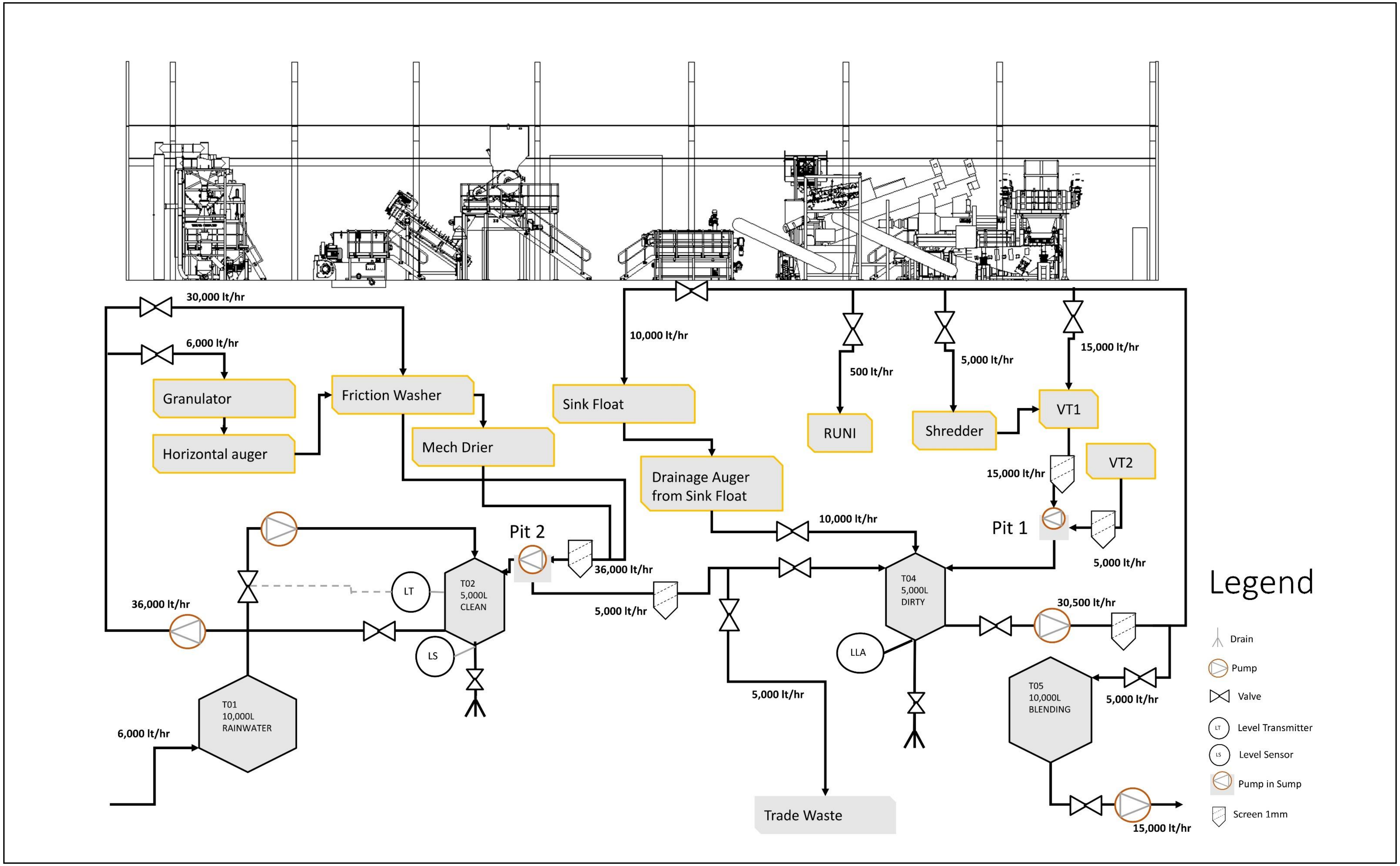


**Figure 5** – A PFD of the wastewater recovery process at PaCE HQ

### 4.2.3 Odour Emission Source Identification and Characterisation

This section aims to identify and characterise the generation of odour emissions based on a technical understanding of the unit of operations at PaCE HQ. This approach seeks to articulate the cause and effect of odour emission generation from the process operations. In this way, a determination of site-specific and compatible odour reduction measures and management protocols can be developed and implemented for all foreseeable operating conditions. This approach also seeks to maintain a practical and sustainable balance between the continuity and reliability of the proposed paint recovery and materials recycling operations and odour control protocols. To that end, the OMA Study has adopted a risk categorisation to provide an index on the severity of odour risk associated with each key process step (refer to **Table 1**). This approach is intended to provide a rationale for the adoption of any odour control, risk reduction measure, and/or appropriate management protocol for the proposed operations at PaCE HQ.

**Table 1** – Odour risk level index for PaCE HQ

| Trigger Level | Description |
|---|---|
| **Level 1** | The risk of leading to off-site odour impact is considered low and can be resolved by competent operation and routine maintenance.<br><br>The definition of low is a probability of occurrence that is between very unlikely to unlikely. This is based on a technical understanding of the process operations and resultant odour emissions. This is assessed in the absence of any odour control, risk reduction measure, or appropriate management protocol. |
| **Level 2** | The risk of leading to off-site odour impact is considered medium if the nature of operations involves exposure of process material with the potential to release volatile emissions in an indoor or outdoor environment under both controlled and uncontrolled airspaces.<br><br>The definition of medium is a probability of occurrence that is possible under specified conditions. This is assessed in the absence of any odour control, risk reduction measure, or appropriate management protocol. |
| **Level 3** | The risk of leading to off-site odour impact is considered high if sustained for prolonged periods of time, such as continuous operation, and cannot be resolved without odour control, risk reduction measures, or appropriate management protocol.<br><br>The definition of high is a probability of occurrence that is likely to very likely. This is assessed in the absence of any odour control, risk reduction measure, or appropriate management protocol. |

Based on the detailed process overview documented in **Section 4.2.2**, **Table 2** summarises the risk level index score assigned to each key process step at PaCE HQ, with a discussion and justification provided in **Section 4.2.3.1** to **Section 4.2.3.6**, respectively.

**Table 2 –** Odour risk level index score for the proposed operations at PaCE HQ

| Process Step Description | Risk level index score |
|---|---|
| Process Step 1 – Delivery, receipt, and buffer storage of metal and plastic paint containers. | **Level 1** |
| Process Step 2 – Manual sorting of mixed containers | **Level 1** |
| Process Step 3 – Screw compaction of paint containers (metal and plastic) | **Level 3** |
| Process Step 4 – Plastic by-product processing and secondary water-based paint recovery | **Level 2** |
| Process Step 5 – Storage of recovered materials, recovered metal, and blended water and solvent-based paint streams | **Level 1** |
| Process Step 6 – Solid waste and wastewater recovery and management | **Level 2** |

#### 4.2.3.1 Process Step 1 Odour Risk Index Score Justification

Process Step 1 involves the delivery, receipt, and buffer storage of metal and plastic paint containers. All delivery of metal and plastic paint containers to PaCE HQ will be by heavy or light vehicle transport. All water and solvent-based paint containers received at PaCE HQ are expected to originate from regulated and source-separated collection depots across the country. As such, all containers will be required to be sealed for transportation. This will be the condition in which paint containers are expected to be received at PaCE HQ. Therefore, unprocessed paint containers' delivery, receipt and buffer storage will be a minor source of odour emissions at PaCE HQ. All unprocessed paint containers will be stored in the buffer stillage storage for subsequent processing. For these reasons, Process Step 1 is assigned an odour risk level score of Level 1, as the source of odour emissions will be contained and controlled during this process step.

#### 4.2.3.2 Process Step 2 Odour Risk Index Score Justification

Process Step 2 involves the manual sorting of mixed containers. The inbound stillages of solvent and water-based paint in plastic and metal containers will be sorted manually and fed onto a conveyor based on their construction material (plastic/metal) and contents (solvent/water-based paint). Any foreign objects and materials (by-catch) will be removed at this point and stored securely in appropriate cabinets. The sorting will be completed by trained and experienced operators to optimise the separation of metal or plastic containers. At this point, all containers will be sealed unless the operator determines that the contents of a container are required to be investigated as it may not have passed the standardised inspection and quality protocols that qualify a container for processing. For these reasons, Process Step 2 is assigned an odour risk level score of Level 1, as the source of odour emissions will be contained and controlled during this process step.

#### 4.2.3.3 Process Step 3 Odour Risk Index Score Justification

The screw compaction of metal and plastic paint containers. As indicated in Process Step 3A and Process Step 3B in **Section 4.2.2**, there will be a dedicated water-based or solvent-based IECEx rated large diameter feeding auger and screw compactors, a SK730 RUNI where the container material will be compressed, and the extruded paint will be collected into IBCs. The metal containers containing solvent-based paint will be transferred via a conveyor to perforated stillage for passive drying (refer to SBP metal in **Figure 3**). The compressed and dried metal container stillages will subsequently be externally distributed to a licensed metal recycler. The water-based containers (both plastic and metal) will be processed through a further washing plant to refine them to a recycling condition.

It is at this process step a container's seal (metal and plastic) is breached, and paint contents are mechanically separated by high-efficiency screw compaction. This is for both solvent and water-based paint containers (metal and plastic). This process will release odour that is likely to release odour at a rate and frequency that could lead to on-site and off-site odour nuisance, given the high duration and frequency of continuous operation. For these reasons, Process Step 3, specifically the screw compaction via the SK730 RUNI system, is assigned an odour risk level score of Level 3.

After screw compaction, the compressed metal containers should be reasonably free of water-based and solvent-based paints based on the expected operational effectiveness of the SK730 RUNI systems. The compressed plastic containers should have most of the paint recovered following screw compaction; however, it will require further processing to remove any residual paint and enable the quality of the recovered plastic to be reused (refer to Process Step 4). The metal containers for solvent-based paints will be stored in perforated stillages for passive drying of any residual paint (this is expected to be very low) prior to external distribution to a metal recycler. The residual paint after compaction for both plastic and metal containers is expected to be kept to a minimum as there is a commercial incentive to maximise and optimise primary paint recovery during the screw compaction process (as compared with secondary paint recovery from Process Step 4). For these reasons, a sub-assignment odour risk level score of Level 2/3 is nominated for the perforated stillages containing the compressed solvent-based metal containers, subject to operational effectiveness.

#### 4.2.3.4 Process Step 4 Odour Risk Index Score Justification

Further processing of metal and plastic containers and secondary water-based paint recovery. As shown in **Figure 4**, the water-based plastic and metal containers will undergo further processing. The initial step involves particle size reduction and washing via a FORREC quad shaft shredder into 50 mm pieces before flowing onto two FORREC vibration screens to remove any excess water (dewatering). At this stage, the shredded metal packaging will be collected and stored in an industrial bin. This will undergo external distribution to a licensed metal recycler. The plastic will undergo further processing, including further washing, separation, granulation, drying, and bagging. Process Step 4 will only occur once a week, reflecting a low operational frequency and duration. For these reasons, Process Step 4 is assigned an odour risk level score of Level 2.

#### 4.2.3.5 Process Step 5 Odour Risk Index Score Justification

The storage of recovered materials, recovered metal, and blended water and solvent-based paint streams will consist of two sub-process steps as follows:

- **Process Step 5A** - Downstream of Process Step 4, the recovered water-based paint will be blended and processed to a specific solid content to meet customer requirements, and biocide will be added to treat existing microbes and prevent future biological growth and fouling of the paint - this step will extend shelf life of the recovered water-based paint product. The finished water-based product will be stored in IBCs and transferred to the internal storage warehouse prior to dispatch; and

- **Process Step 5B** – The solvent-based paint will be collected in IBC's and transferred to the internal storage warehouse via forklift. The solvent-based paint will be used as an alternative fuel in cement kilns or undergo thermal destruction.

It is understood that the wash water will be closed circuit and solvent-based paint stored in sealed IBCs. For the above reasons, Process Step 5A and Process Step 5B are assigned an odour risk level score of Level 1.

#### 4.2.3.6 Process Step 6 Odour Risk Index Score Justification

Process Step 6 consists of solid waste and wastewater recovery and management. PaCE HQ will utilise a wastewater treatment process to facilitate in the treatment of wastewater generated from the water-based paint and plastic recovery process. The intent will be to concentrate water-based paint in the blending tank. The mixing and blending station will occur in covered tanks. The shredded and separated metals will be stored in an industrial bin for external distribution to a metal recycler. All solid waste material will be either in a dried or dewatered condition prior to disposal in an open-top skip bin. This will reduce the overall odour emission potential from Process Step 6. For these reasons, Process Step 5A and Process Step 5B are assigned an odour risk level score of Level 2.

## 5. Optioneering Analysis

As part of the OMA Study, TOU carried out an optioneering analysis in the context of potential air emissions control protocols for the proposed operations at PaCE HQ. This enabled the identification and ranking of the most appropriate emissions control option/s from a technical standpoint, environmental performance, and practicality of implementation at PaCE HQ. As part of the OMA Study, TOU examined all operational processes adopted at PaCE HQ and the readily available odour emission control technology that can be utilised for problematical areas and/or to reduce the risk of potential off-site odour impact performance from the paint recovery and materials reuse activities. To that end, in undertaking the OMA Study, TOU has drawn on the following information bases, namely:

- TOU's extensive knowledge and skills in the field of odour control design and engineering;

- A literature review of readily available technologies specific to the paint processing industry, both nationally and internationally (if relevant and suitable for Australian conditions); and

- Existing paint and chemical-based processing facilities, including similar, smaller, and larger scale operations to Pace HQ, with volatile organic compounds (**VOCs**) as the dominant source of odour emissions. TOU notes that the integrated paint recovery operations are distinct from a paint or surface coating processing facility where the operations unit differs from a paint recovery/recycling operation. This distinction results in a vastly different odour emissions matrix from the process operations.

In reviewing the possible odour risk reduction and technology options for PaCE HQ, it is important to consider the following key factors:

- The optimum mode of treatment including physical, chemical and/or biological;
- The solubility and dissociation of the target odorous compounds into the liquid phase, biological film boundary layer, or by adsorption/absorption processes;
- The thermodynamic influences on the choice of odour control technology, such as temperature and moisture control;
- The required level of odour removal performance;
- The on-going operational and maintenance requirements with employed odour control technology;
- Available real-estate and constraints;
- Capital expenditure and operating expenditure versus benefit and actual performance; and
- How readily established is the efficacy of the employed odour control technology in the paint recovery sector; and
- How reasonably practicable it is to implement at PaCE HQ.

The above factors are considered in the odour management and risk reduction measures conducted in the OMA Study.

## 5.1 Recommended Odour Risk Reduction Measures/Engineered Controls

Based on the optioneering analysis conducted as part of the OMA Study, the following odour risk reduction measures and engineered controls are recommended at PaCE HQ:

- **High-rate airflow extraction and dispersion**: This option is readily adopted for large building volumes where there is a dynamic working floor area and material flow. The advantages include moderate capital and low operating costs, relatively easy to retrofit to existing buildings, and favourable for achieving operator comfort and good air quality in an indoor environment. The disadvantage is that it can require a modest upgrade to the building fabric through effective sealing and containment; and
- **Activated carbon filter**: This involves passing air through a column of activated carbon medium, resulting in the adsorption of air containments by adsorption and/or physical-chemical reactions (depending on the type of carbon selected). It is typically used as a polishing treatment stage, as primary treatment in low volumetric airflows or as a backup/redundancy treatment step. The advantages include an excellent removal performance of a range of odorous compounds and air contaminants, a non-hazardous filter medium and ease of replacement, and reasonably low to moderate capital and operating costs. The disadvantages include that the activated carbon filter medium can be rapidly exhausted, particularly with saturated and/or heavily contaminated airstreams and can be prone to blockages if contaminated air is heavily laden with dust or grease/oils. Also, a modest real estate footprint can be required for large treatment airflows.

The site-specific implementation of these options at PaCE HQ is further discussed in **Section 5.2**. The balance of technological options or risk reduction measures excluded as feasible or viable options includes electrostatic precipitator, dry/wet scrubber, biological scrubber (or bio-scrubber), biotrickling filter, biofiltration, thermal oxidiser, and advanced oxidation process/fogging systems/oxidising agents. The individual or collective reasoning for this includes, but is not limited to:

- Real estate constraints to accommodate for large building airflow extraction rates;
- Ineffective or unproven adoption (due to a lack of technical evidence or industry application) for paint processing derived odour emissions in Australia;
- Limited method of application;
- Operationally or environmentally unsustainable for paint processing derived odour emissions;
- Energy and greenhouse gas emissions intensive; and/or
- Inconsistent with the principles of BATEA when site-specific technical and practicable factors are considered.

### 5.1.1 Utility of Separation Distance

Further to that documented in **Section 5.1**, it is noted that the optioneering analysis conducted for PaCE HQ does not include the reliance or place heavy weighting on the adoption of separation distance as a viable odour risk reduction measure. This is due to the site locality and context, the relatively short range of source-pathway-receptor between the point of release and receiving environment as described in **Section 3**, and the impact of cumulative emissions from the existing industrial context within a 500-metre radius to PaCE HQ. Therefore, the optioneering analysis focuses on high-efficiency paint recovery equipment, operational excellence, process optimisation and continuous improvement, and engineered controls at targeted locations.

## 5.2 Recommended Odour Management and Risk Reduction Measures

For PaCE HQ, TOU recommends the adoption of the following:

- **High-rate airflow extraction and dispersion**: This should be adopted to enable a well-ventilated building environment. The extracted building ventilation air should be discharged to the atmosphere with favourable initial plume dispersion properties. The building airflow extraction rate should be compatible with the current condition of the building fabric, such that a differential negative pressure is achieved within the indoor airspace. This minimises the potential for fugitive emission release at ground level or from ingress/egress areas involving doorways or openings. This approach relies on effectively capturing and treating major odour sources from the paint recovery operations at PaCE HQ. This is further detailed in **Section 5.2.1**; and
- **Activated carbon filter**:
    - As mentioned in **Section 4.2.3.3**, Process Step 3, specifically, the screw compaction via the SK730 RUNI systems is assigned an odour risk level score of Level 3. Given the nature of the process activity, this is expected to result in the majority of odour emissions. The residual paint after compaction for both plastic and metal containers is expected to be kept to a minimum as there is a commercial incentive to maximise and optimise primary paint recovery during the screw compaction process. Therefore, the SK730 RUNI screw compactor system should be point source captured, treated via a suitably designed activated carbon filter, and atmospherically released with favourable initial plume dispersion properties. This is further detailed in **Section 5.2.2**; and
    - As mentioned in **Section 4.2.3.3,** downstream of Process Step 3A**,** a sub-assignment odour risk level score of Level 2/3 is nominated for the perforated stillages containing

the compressed solvent-based metal containers, subject to operational effectiveness. This area will likely contain diffuse rates of volatile odour emissions for extended periods (this will vary seasonally and be impacted by the nominated building air extraction rate). Therefore, given that the ideal air exchange rate of fifteen (15) air changes per hour (refer to **Section 5.2.1**) is not possible due to noise and other practical factors, the diffusive volatile emissions from the perforated stillages could be managed via a reduction in drying times by internal mixing fans in this area to promote better cross-flow if found to be required.

The recommended design configuration results in two (2) quantifiable odour emissions, namely:

1. The roof vent emissions servicing the extracted building ventilation air. The total number of roof discharge points for the building ventilation air extraction system is expected to be six (6); and

2. The treated emission from the activated carbon filter system. This emission should be of a treated quality emission that contains none of the original offensive paint odour descriptions (such as sweet, fruity, chemical, pungent) and be non-problematical from an odour impact perspective. The total number of roof discharge points for the activated carbon filter system is expected to be at least two (i.e., a single discharge point per activated carbon filter system).

### 5.2.1 High-Rate Airflow Extraction and Dispersion

There are generally two (2) approaches to high-rate airflow extraction in process buildings for the purposes of odour control in Australia. These include:

1. The **'Full Capture'** approach, involving the treatment of all air from inside the main processing buildings/rooms, including process air and ventilation airflows; and

2. The **'Split System'** approach, where process air is captured and treated from each of the processing units within the processing plant, and ventilation airflows are force-vented direct to the atmosphere, through roof-mounted exhaust vents.

If required, Full Capture systems can maintain a negative pressure environment inside all processing buildings, at the cost of much larger airflows and larger odour control systems - fugitive odour emissions under this configuration are effectively prevented. The Split System approach relies on capturing and treating the major odour-generating source/s in the processing building such that environmental odour objective can be met without needing full odour capture. This system depends upon a well-designed and more extensive odour capture ducting system and sound operation and maintenance of this system.

For PaCE HQ, the Split-System design can be adopted for the proposed paint recovery operations, given the factors discussed in **Section 5.1**. It should be noted that this selected configuration could be validated as part of an odour dispersion modelling study to advise on the engineering design process (such as stack height and velocity). However, based on the design specifications contained in the OMA Study, TOU does not anticipate the odour dispersion modelling study to impact the Split-System design selection for the proposed operations at PaCE HQ as it is based on an inherently conservative design basis.

For the high-rate airflow extraction protocol to be effective at PaCE HQ, a minimum ventilation rate through the building fabric is required for operator comfort and safety, typically expressed as 'air changes per hour'. Without an adequate ventilation rate, plant operators will invariably keep open the large vehicle access doorways, resulting in ground-level, fugitive odour emissions that disperse poorly. Depending on the local climate, a minimum of fifteen (15) air exchanges per hour is regarded as the ideal rate (if practical), twenty (20) exchanges/per hour in warm areas, with even higher rates as the target in hot climates or thermal-intensive operations. These factors are considered and reviewed in the context of noise sensitivity as part of the OMA Study for PaCE HQ (noting that the balance between odour and noise limits the maximum number of air changes practically achievable – refer to **Section 5.2.1**). Furthermore, given that the paint recovery operations at PaCE HQ are classified as dangerous goods, there is also the requirement to design the building airflow extraction according to Australian Standard 1940 (**AS 1940**), which defines the storage and handling of flammable and combustible liquids. To that end, the key design requirements for the high-rate airflow extraction and dispersion to ensure effective odour emissions management during normal operations at PaCE HQ will be as follows:

- A minimum air exchange rate of five (5) air changes per hour. Based on a building process floor area of approximately 800 $m^2$ (total building area is 1,600 $m^2$) and height of 8 m, the total volumetric displacement rate by the mechanical air extraction system will need to be 32,000 $m^3$/hr (equivalent to approximately 533 $m^3$/min). This exceeds the requirements of AS 1940 and is suitable to facilitate effective dilution and dispersion of odour emissions for the proposed operations at PaCE HQ (note the air extraction rate of the activated carbon filter is excluded from this calculation);

- Based on the need to maintain a maximum discharge velocity of 5 m/s (for noise), this will likely result in six (6) individual short stacks (1-2 metres above roof level) across the roof profile of the building;

- For a total airflow extraction rate of 32,000 $m^3$/hr, as a minimum guide, the airflow balance should consist of the mechanical supply of fresh air that is less than the extracted rate with the fresh air make-up passively supplied from existing building and/or engineered openings. This airflow balance configuration will generate a negative differential pressure (or net inflow of fresh air) within the building airspace, minimising fugitive emission release and ensuring that all emissions are discharged to the atmosphere in a controlled and effective manner; and

- This process will be serviced by a low-level extraction system, with a possible conceptual cross-airflow pattern as shown in **Figure 6**. This will ensure that the requirement for AS 1940 is adequately met while maintaining a well-mixed and ventilated indoor airspace (this may be facilitated by internal mixing fans). A strong correlation exists between maintaining good air quality within an indoor airspace and managing odour emissions, particularly if the major process source/s are adequately captured and treated via a dedicated odour control system. This is applicable to the screw compaction process (refer to **Section 5.2.2**).

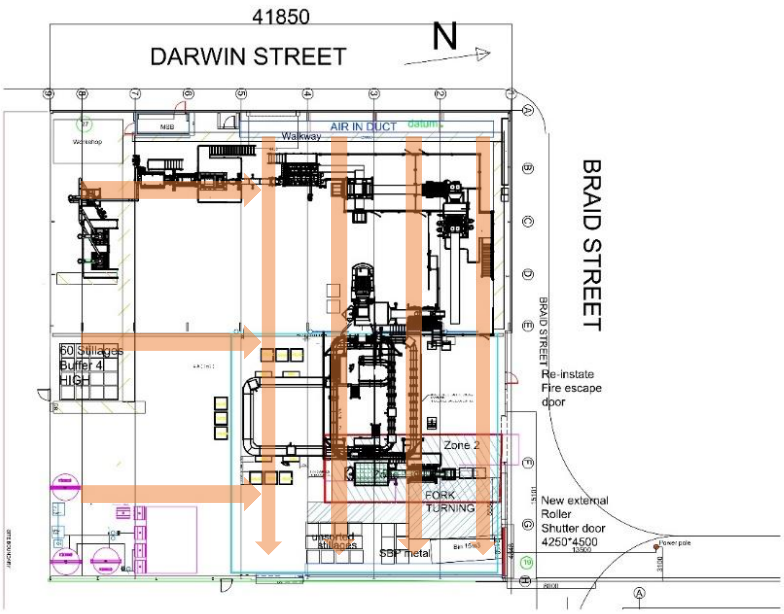


**Figure 6** – A possible conceptual airflow pattern for the paint recovery operations at PaCE HQ

### 5.2.2 Activated Carbon Filter System

An activated carbon filter system will service the screw compaction process (refer to **Section 5.2.2.1** for details) at the PaCE HQ. Similar to that mentioned in **Section 5.2.1**, an odour dispersion modelling study can advise on the engineering design process such as final stack height, velocity, and appropriate outlet odour targets) for the activated carbon filter system. However, based on the design specifications contained in the OMA Study, TOU does not anticipate the odour dispersion modelling study to impact the selection and design of the activated carbon filter system as the nominated odour performance targets documented in **Section 5.3** can be considered typical industry standards.

#### 5.2.2.1 Screw Compaction

The screw compaction of metal and plastic paint containers will require a direct point-source connection to each of the SK730 RUNI systems for effective and targeted capture of process emissions. The extracted emissions should flow into two (2) activated carbon filter beds in series prior to atmospheric release. To that end, the key design requirements for the activated carbon filter system servicing the screw compaction process will be as follows:

- An airflow extraction rate of 750 $m^3$/hr per SK730 RUNI system;
- An activated carbon filter system per SK730 RUNI system, configured in series to manage breakthrough, allow ease of changeover, and operational continuity and contingency;
- Each activated carbon filter system should have a dedicated stack discharge point within a minimum stack velocity of 5 m/s. On this basis, the discharge height can be short (1-2 metres above roof level); and
- The carbon filter medium should have an affinity for volatile organic compounds (broad spectrum, granular or pelletised carbon are possible options). There are several Australian suppliers on the market that can provide this solution.

#### 5.2.2.2 Passive Drying of Compressed SBP Metal Containers

The passive drying of compressed SBP metal containers will likely represent a source of diffuse rates of volatile odour emissions for extended periods (this will vary seasonally and be impacted by the nominated building air extraction rate). Therefore, given that the ideal air exchange rate of fifteen (15) air changes per hour (refer to **Section 5.2.1**) is not possible due to noise and other practical factors, the diffusive volatile emissions from the perforated stillages could be managed via a reduction in drying time by internal mixing fans in this area to promote better cross-flow if found to be required.

### 5.3 Odour Performance Targets

Based on the recommended approach contained in the OMA Study documented in **Section 5.2**, the following performance targets are expected to be achieved at PaCE HQ:

- Negligible fugitive emission release from the process building, which significantly minimises the risk of near-field and short-range odour impacts. This is particularly important given the proximity to sensitive receptors;
- A controlled building air ventilation capture, mixing, dilution, extraction, and dispersion. This will promote a well-mixed and diluted airstream with low odour concentration levels. The minimum discharge velocity from each roof-mounted fan will be 5 m/s. The design target odour performance is expected to be 500 odour units (**ou**) or less from each ventilation fan. This is on the basis that the activated carbon filter systems are installed on the screw compaction process, drying times in the compressed SBP metal containers are minimised, and the paint recovery operations are effectively operated and always maintained; and
- A minimum discharge velocity of 5 m/s for the activated carbon filter system discharge points. This will promote favourable initial plume dispersion. The treated outlet performance should

be 500 ou or less, with none of the original inlet odour character present in the treated airstream. This will be monitored by establishing an appropriate total VOCs target and monitoring protocol to identify any breakthrough and trigger replacement of the activated carbon filter medium. This will address odorous compounds typically associated with including, but not limited to ethyl acetate, styrene, xylenes, acetone, toluene, ethanol, glycol ethers.

## 6. Concluding Remarks

It is anticipated that the nominated performance targets documented in the OMA Study will be used to guide the engineering design process for the proposed odour management and control protocols at PaCE HQ. Furthermore, to add further confidence to the proposed options documented in the OMA Study, the design and performance targets could be validated by dispersion modelling as part of the engineering process to optimise stack design and confirm the suitability of the nominated performance targets. However, based on the recommended design specifications, TOU does not anticipate that the outcomes from the odour dispersion modelling study will significantly affect the design configuration of the proposed odour management and control options at PaCE HQ, given the inherently conservative design basis. It is noted that noise attenuation is outside of the scope of the OMA Study and will need to be considered in the context of the proposed odour management and control options documented in the OMA Study.

Under the recommended approach and performance targets outlined in the OMA Study, TOU considers that the proposed operations at PaCE HQ will be reasonably mitigated with BATEA, and future odour impacts at nearby sensitive receptors are expected to be adequately mitigated such that the general environmental duty is achieved from an odour emissions perspective.

Signed by:

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