

Surface Water Screening Assessment, M&I Materials, Trafford

1.0 Introduction

In order to increase the production capacity and improve the operational effectiveness of the permitted synthetic ester production installation at Trafford Park, M&I Materials Limited are seeking to vary their existing environmental permit. In response to changing demands, the operator is installing a further reactor to Line 3 that will increase its production capacity and a distillation column to Line 1 to increase the range of products it can manufacture. As a result of this change the EA has asked for further assessment of potential impact of emissions to water from this change.

The installation currently generates small volumes of effluent (maximum daily volume utilising Lines 1-3 with 13.5 hour batch time results in up to a maximum of 7.5m³ process effluent per day which would potentially increase to a maximum of 9.4m³ day). The wastewater generated by the installation is a consequence of its synthetic ester production processes. Water formed in the reaction vessel during the esterification process boils off, together with some fatty acid. This is passed through the condenser and is separated in a tank under gravity with the acid being returned to the reactor and wastewater being passed via a holding tank where it is neutralised through a limestone bed to give a ten-fold reduction in acid value which is monitored regularly before release to the onsite foul drain. There are no other processes that give rise to effluent generated by the activity such as washdown of equipment etc.

The overall site has a trade effluent discharge consent from United Utilities (Consent Ref 694TLS26M039) that limits total site wide releases to 20m³ per day. Process effluent from the regulated installation joins the wider site combined drainage before discharge via the consented release point to public sewer. The introduction of a third reactor under this variation will result in an approximately 25% uplift of the emissions of process effluent from the regulated installation that contributes to the overall site discharge which the operator will continue to comply with. Trade effluent from the installation therefore equates to around 47% of the total permissible daily volume for the site.

Site drainage ultimately discharges to United Utilities Davyhulme Wastewater Treatment Works facility at Rivers Lane Davyhulme M41 7JB. Following further treatment stages, treated sewage is discharged by United Utilities into the Manchester Ship Canal under the terms of their environmental permit.

2.0 Screening Assessment Methodology

The aim of this screening assessment is to appraise the potential effect of emissions to water from the permitted facility.

In accordance with government guidance prepared by both the Environment Agency and the Department for Environment, Food & Rural Affairs, a Surface water pollution risk assessment has been undertaken for the Site. This surface water pollution risk assessment involves three stages:

- 1) Identification of pollutants released from the plant;
- 2) Gathering of data on pollutants released from plant; and,

3) Screening tests on data.

The following section will document the assessment methodology and the associated findings within each of these stages.

3.0 Screening Assessment

The following assessment was conducted on data provided by the operator in relation to their raw materials inventory that may contribute to the wastewater stream and an analysis of the chemical characteristics of the effluent produced by the Site. As such, the process steps following the stage that gives rise to wastewater, such as the addition of additives (including performance enhancers and other powders) have been discounted from the assessment. The aim of this is to evaluate key potential pollutants within the chemical inventory and effluent to determine whether they pose a potential risk to surface waters upon discharge.

The assessment has appraised the proposed worst-case position and effluent production in line with the proposed increase in production volumes.

3.1 Identification of Pollutants

This section presents the chemical inventory of liquid products used at the Site, which may have the potential to enter the effluent or may be considered chemical constituents of the effluent itself from the permitted installation. This screening stage included the examination of Material Safety Data Sheets (MSDS) to identify priority pollutants as determined by the EA and other substances that exhibit eco-toxic hazard codes.

A summary of potentially toxic constituents is presented in Table 1.

Table 1: Summary of Ecotoxicological Substances

Material Number	Product Name	Description	Compounds of Concern	Risk Comment
115-77-5	Perstorp	Polyol	Pentaerythritol	Not Hazardous
126-30-7	Neopentyl glycol Flakes	Fatty Acid	2,2-dimethylpropane-1,3-diol	H318
111-14-8	Heptanoic	Fatty Acid	n-Heptanoic Acid	H332, H314, H335
149-57-5	Perstop 2 Ethyl hexanoic	Fatty Acid	2 Ethyl hexanoic acid	H361d
112-05-0	Pelargonic	Fatty Acid	Pelargonic acid	H315, H319, H412

3.2 Screening Test

The review in Section 3.1 above has identified a schedule of substances that require further evaluation to determine emissions to water. All other chemical constituents have been discounted for further consideration as they are not included on the EA priority substance list and do not register an eco-toxic hazard code on the MSDS.

The remaining constituents of concern identified during the initial screening of the chemical inventory are screened within this section. These potential pollutants do not have EQS screening values as either freshwater priority or priority pollutants under the EA guidance. They do not feature within the H1 screening tool. However, for completeness these compounds have been assessed in accordance with the EA methodology to determine the potential effect of these emissions to water.

Based on the raw materials inventory the compound of concern for further screening is pelargonic acid, a fatty acid (H412 – harmful to aquatic life).

In order to appraise the emission analysis data for the discharge from the installation to drain was obtained. Within the volatile free fatty acids suite tested for, the concentration and proportion of each specific compounds detected within the effluent stream is:

- acetic acid 48mg/l (3%)
- hexanoic acid 970mg/l (77%),
- heptanoic acid 240mg/l (20%)

Whilst pelargonic acid is not specifically identified in the free fatty acids analysis suite for the purpose of the assessment it is assumed that the total fatty acids loading from the site may have the same hazard characteristics as pelargonic acid.

Effluent is discharged to sewer under Trade Effluent Discharge Consent with United Utilities Water. It is understood that all site effluent discharges to Davyhulme Wastewater Treatment Works facility at Rivers Lane Davyhulme M41 7JB prior to discharge to the Manchester Ship Canal. As such, 'Sewage Treatment Reduction Factors' (STRF) are considered for the constituent of concern as the additional treatment step may result in further reduction of chemicals within the discharge.

United Utilities has confirmed that wastewater discharged from the Site is subject to treatment at Davyhulme and that the works comprises various stages of treatment including the physical screening of the inlet, both primary and secondary dosing units to remove phosphorous, settlement tanks, activated sludge plants and a mechanically aerated oxidation sludge treatment – sludges pumped from the settlement tanks are treated via screens, blending tanks, drum thickeners and anaerobic digesters before dewatering and centrifuge to generate sludge cake.

On this basis, the operator sought to apply the relevant sewage reduction factor (STRF) to the compound being assessed to appraise reductions of concentrations as a consequence of the wastewater treatment works stage prior to discharge. The STRF applied is that published by the EA for an activated sludge plant. It is noted that these reduction factors may be conservative given the extent

of treatment that is performed at the Davyhulme works by United Utilities. The STRF calculation is as follows. The total predicted releases are presented in Table 2 below.

$$(3.1) \text{ Concentration of component discharged} = \text{emission rate} \times \text{STRF}$$

Table 2: Summary of Emission Rates and Sewage Reduction Factors.

Constituent of Concern	Predicted Emission Rate [mg/l]	Activated Sludge Plant Sewage Reduction Factor (RF)	Total predicted release concentration to freshwater [mg/l] = Predicted Concentration*RF
All fatty acids	1258	0	1258

The operator notes that published sewage reduction factors is not available the constituent of concern. As such, a qualitative assessment has been made.

All fatty acids are mildly acidic and will impact pH. It is anticipated pH would buffer readily when mixed with combined flows from the rest of the site and within the sewer network beyond the Site and ultimately at the wastewater treatment works. Any mildly acidic conditions would be overcome by the mass of effluent at the works and that would dominate the wastewater characteristics. The fatty acids would be metabolised or degraded during biological, chemical and / or oxygenation processes at the works and potential for discharge to surface waters post-treatment would be insignificant. This hypothesis is supported by the fact that the types of fatty acids potentially discharged are commonly used in a range of industrial applications including the production of plastic products, water treatment chemicals, cosmetics and personal care products and that the MSDS that highlights biological treatment for any materials recovered following a spill.

4.0 Findings and Conclusions

The permitted facility generates effluent wastewater as a result of the esterification process which is discharged from the installation to site foul drainage before entering the public sewer under consent from United Utilities. Draining from the condensers is treated prior to entering the site drains and will undergo further treatment by Davyhulme wastewater treatment works. The final receiving water body is the surface waters of the Manchester Ship Canal West of Trafford.

The operator has reviewed the raw materials inventory and chemical characteristics of the effluent discharged from the permitted facility. The assessment has reviewed the current annual discharges and the predicted increased volumes expected following increase in synthetic ester production capacity.

Of the chemical inventory reviewed no substances can be screened using the H1 screening method. The chemical constituents do not feature on the EA priority substance or freshwater EQS schedule. The operator has performed a qualitative risk appraisal of those compounds to appraise potential risks. This assessment has concluded that remaining residues of fatty acids would be readily neutralised by the mass of effluent at the works and that would dominate the wastewater and metabolised or degraded

during biological, chemical and / or oxygenation processes at the works. The potential for discharge to surface waters post-treatment therefore assessed as insignificant significant

It is further noted that the dry weather flow limits for this works is understood to be 340,000M³. At maximum discharge the overall contribution from the entire site is less than 0.0001% of the outfall release to the local receiving water. The presence of fatty acids within the effluent is not considered to pose a significant risk given that the United Utilities facility will perform treatment necessary to maintain compliance with their environmental permits and protection of the environment upon discharge to surface water.