PUB SINGAPORE'S NATIONAL WATER AGENCY

## A Guide for Industries

# MANAGEMENT OF TRADE EFFLUENT DISCHARGE INTO THE PUBLIC SEWERAGE SYSTEM

## 2nd Edition – Sept 2025

### About PUB, Singapore's National Water Agency

PUB is a statutory board under the Ministry of Sustainability and the Environment (MSE) that oversees water issues in an integrated way. PUB's mission is to ensure Singapore has a reliable and secure water supply, and protect it from inland and coastal flooding.

Through the Four National Taps (local catchment water, imported water, NEWater, desalinated water), PUB has ensured a diversified and sustainable supply of water for Singapore. PUB also manages both inland and coastal flood risks holistically, and leads and coordinates whole-of-government efforts in ensuring coastal and flood resilience.

PUB actively engages with stakeholders including residents and businesses to promote water conservation and flood resilience, emphasising that everyone has a vital role in safeguarding Singapore's precious water resources and being flood-resilient against the backdrop of climate change.

**Produced by: PUB, Singapore's National Water Agency**



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FOREWORD

# WORKING TOGETHER TO ENSURE TRADE EFFLUENT COMPLIES WITH THE LEGISLATION

PUB, Singapore's National Water Agency, administers the Sewerage and Drainage Act (SDA) and its regulations, which include the Sewerage and Drainage (Trade Effluent) Regulations [SD(TE)R].

The SD(TE)R stipulates the requirements for discharging trade effluent into the public sewerage system. The discharge of non-compliant trade effluent may cause:

(a) Disruption of the biological treatment process at Water Reclamation Plants (WRP),
(b) Disruption of NEWater production,
(c) Health and safety risks to workers maintaining the public sewerage system, and
(d) Disruption of the smooth conveyance of used water in the public sewerage system.

By proactively taking steps to ensure your trade effluent discharged into the public sewerage system complies with the legislation, you can help to ensure each drop of used water collected is fit for recycling to NEWater.

## PURPOSE OF THIS GUIDEBOOK

This guidebook aims to provide the importance of trade effluent management, an overview of the trade effluent legislation in Singapore, and the good practices you can adopt in safeguarding our used water resources. The first edition was published in 2007. This current edition incorporates the latest legislative updates and provides the best practices for managing trade effluent discharge into sewers and maintaining oil interceptors.

We hope that you find this guidebook beneficial, and we look forward to a collaborative partnership with you.

Herman Ching
Director
Water Reclamation (Network) Department
PUB, Singapore's National Water Agency



# 1 PUB'S WATER LOOP

PUB is a statutory board under the Ministry of Sustainability and the Environment (MSE) that oversees water issues in an integrated way. PUB's mission is to ensure Singapore has a reliable and secure water supply, and protect it from inland and coastal flooding. Our holistic approach to water management can be categorised into three key strategies:

(a) Collect every drop of water
(b) Reuse water endlessly
(c) Desalinate seawater

Through the Four National Taps (local catchment water, imported water, NEWater, desalinated water), PUB has ensured a diversified and sustainable supply of water for Singapore (Figure 1). PUB also manages both inland and coastal flood risks holistically, and leads and coordinates whole-of-government efforts in ensuring coastal and flood resilience.

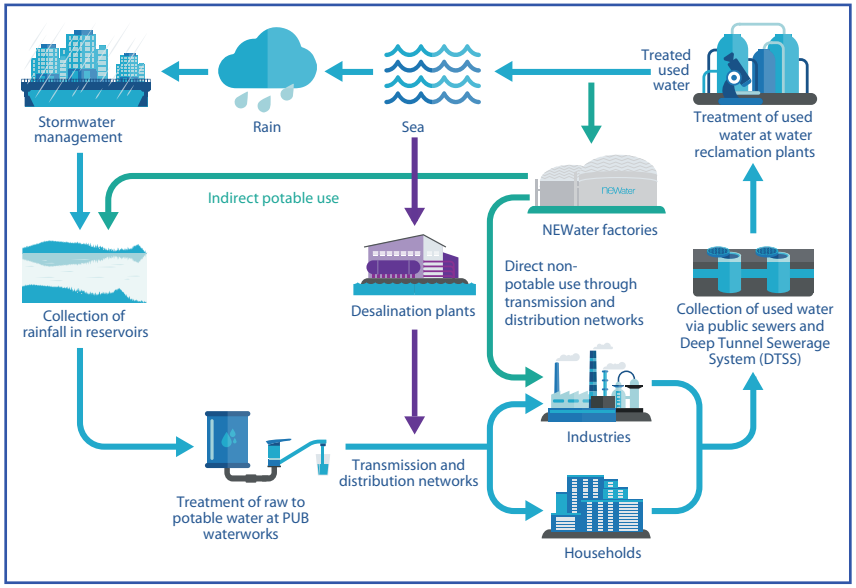



Figure 1: PUB manages the entire water loop - from rainwater collection and used water treatment, to the supply of clean drinking water.

## 2 HOW DO YOU FIT INTO PUB'S WATER LOOP

Used water from residential estates, industries, and commercial premises (including eating establishments) is collected and conveyed via an extensive sewerage network system (Figure 2) for treatment at the Water Reclamation Plants (WRP). It is further purified using membrane technologies and ultra-violet disinfection to produce high-grade reclaimed water known as NEWater. Descriptions of our used water treatment and NEWater production processes are provided in Annexes A and B respectively.

NEWater is a weather resilient resource, cushioning our water supply against dry weather and enhancing Singapore's water sustainability. Therefore, it is crucial to ensure that used water discharged can be efficiently conveyed to WRPs and is fit for NEWater production. You can play your part in protecting this valuable water resource by complying with the Sewerage and Drainage Act (SDA) and the Sewerage and Drainage (Trade Effluent) Regulations [SD(TE)R].

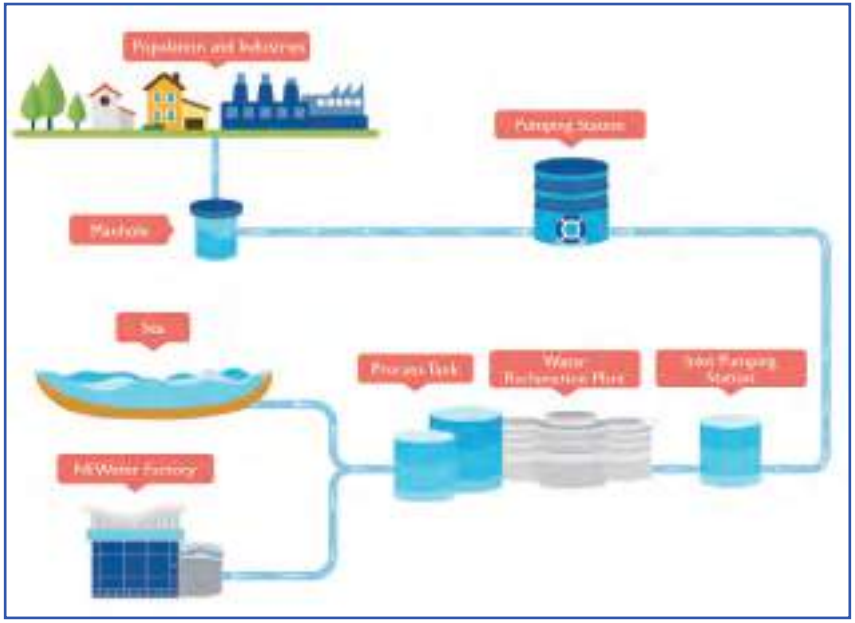



Figure 2: The public sewerage network system conveys used water from industries and households to the WRPs.

## 3 WHY MUST THE DISCHARGE OF TRADE EFFLUENT INTO THE PUBLIC SEWERAGE SYSTEM BE CONTROLLED

The public sewerage system conveys used water to the WRPs for biological treatment using micro-organisms. The treated used water can then be further purified to produce NEWater or be discharged to the sea without affecting the environment.

Discharging trade effluent containing prohibited substances or excessive concentrations of regulated substances may inhibit biological treatment process at WRPs.

Figures 3a and 3b illustrate examples of illegal discharges which have affected PUB's WRP operations.

Figure 3a: Aeration tank covered with "foam". This can be caused by the illegal discharge of certain heavy metals, which inhibit the biological treatment process and the breakdown of detergents.

Figure 3b: Raw sewage contaminated by remnants of partially degraded coloured dyes from trade effluent discharged by factories.

## 4 HOW YOU CAN PLAY YOUR PART

You play a crucial role in sustaining PUB's Water Loop. By taking proactive steps and treating your trade effluent before discharging it into the public sewerage system, you can help facilitate the water reclamation and NEWater processes.

Please refer to Annex C for the good practices in managing trade effluent discharge into the public sewerage system.

# 5 LEGISLATION RELATED TO TRADE EFFLUENT DISCHARGE INTO THE PUBLIC SEWERAGE SYSTEM

PUB administers both the SDA and the SD(TE)R. The SDA governs the provision, operation and maintenance of the public sewerage system, while the treatment and discharge of trade effluent by factories into the public sewerage system are regulated by both the SDA and the SD(TE)R.

**All trade effluent discharged into the public sewerage system shall comply with the requirements and discharge limits stipulated in the SD(TE)R at all times.** You may refer to Annex D for the water quality parameters and their corresponding discharge limits as stipulated in the SD(TE)R.

***The legislation printed in this guidebook is for information only. For the latest legislation, please visit the Singapore Statutes website at https://sso.agc.gov.sg.**

## Sewerage and Drainage Act (SDA)

The key sections relevant to the discharge of trade effluent into the public sewerage system are:

**Section 16 – Trade effluent not to be discharged into public sewerage system without Board's approval**

(1) A person must not discharge, or cause or permit to be discharged, any trade effluent into any public sewerage system or any drain-line or sewer connected to a public sewerage system, except —

(a) with the prior written approval of the Board; and

(b) in accordance with the conditions of that approval (if any) and any regulations under this Act providing for the control of such discharge.

(2) Subsection (1) does not apply to the discharge of any dangerous or hazardous substance or any trade effluent containing any dangerous or hazardous substance under section 16A.

(3) Where any trade effluent has been discharged from any premises into any public sewerage system or any drain-line or sewer connected to a public sewerage system, it is presumed, until the contrary is proved, that the occupier of the premises has discharged, or caused or permitted to be discharged, the trade effluent in contravention of subsection (1).

**Section 17 – Order to stop discharge of dangerous or hazardous substance or trade effluent containing dangerous or hazardous substance**

(1) Where it appears to the Board that any dangerous or hazardous substance or any trade effluent containing any dangerous or hazardous substance is being or has been discharged into any public sewerage system or any drain-line or sewer connected to a public sewerage system, the Board may, by order, direct the occupier of any premises from which the substance or trade effluent is being or has been discharged or any other person who, in the opinion of the Board, has caused or permitted the discharge —

(a) to immediately cease the discharge of the substance or trade effluent into the public sewerage system or the drain-line or sewer connected to a public sewerage system;

(b) to take such steps as may be specified in the order to treat the substance or trade effluent which is complained of; and

(c) to immediately cease the carrying on of any process or work which produces the substance or trade effluent, either indefinitely or until such steps as are specified in the order have been taken to treat the substance or trade effluent before it is discharged into the public sewerage system or the drain-line or sewer connected to a public sewerage system.

## Sewerage and Drainage (Trade Effluent) Regulations [SD(TE)R]

The SD(TE)R specifies the criteria you need to comply with if you wish to discharge trade effluent into the public sewerage system. Some of the key regulations include:

**Regulation 4 – Approval for discharge into public sewerage system**

(1) An application for approval to discharge trade effluent into the part of the public sewerage system, or drain-line or sewer connected to a public sewerage system, specified in the application, made pursuant to section 16(1) or 16A(1) of the Act, as the case may be, shall be in such form as the Board may require.

(4) Where a person has been granted any approval mentioned in paragraph (1), the person must notify the Board in writing, within 14 days after any change in any of the following if the change affects the amount or the physical, organic or chemical nature of the trade effluent discharged:

(a) a process or operation employed or to be employed by him to produce the final products of the trade, manufacture, business or building construction;

(b) a raw material or chemical used or to be used in the process or operation, if notified by the Board to the person in writing;

(c) layout of the machinery, plant and equipment used or to be used in the premises in which the trade, manufacture, business or building construction is being or is to be carried on, as the case may be.

**Regulation 5 – Pre-treatment plant, monitoring and control devices, etc.**

(3) A person must not tamper with —

(a) any sampling test point, inspection chamber, measuring device, or recording and other apparatus installed (whether or not by the person) for the purpose of sampling, inspecting, measuring or recording any trade effluent discharged into any sewerage system; or

(b) any pre-treatment plant installed (whether or not by the person) for the purpose of treating any trade effluent discharged into any sewerage system.

**Regulation 9A – Order to stop discharge of trade effluent containing specified substances**

(1) Where a person discharges or causes to be discharged any trade effluent containing a specified substance into a public sewerage system, or a drain-line or sewer connected to the public sewerage system, the Board may order the person to do any one or more of the following:

(a) immediately stop the discharge of the trade effluent;

(b) take any steps that are specified in the order to treat the trade effluent;

(c) immediately stop the carrying on of any process or work that produces the trade effluent,

and the person must comply with the order.

## 6 PENALTIES FOR DISCHARGING NON-COMPLIANT TRADE EFFLUENT

The table below indicates some of the offences under the SDA and SD(TE)R. For offences under items (b), (c) and (d), the Written Approval (WA) may be revoked.

| S/N | Action | Offence under | Penalty |
|---|---|---|---|
| (a) | Discharged into public sewerage system without Board's approval | SDA | Please visit the Singapore Statutes website. |
| (b) | Nature of effluent did not comply with regulations | SD(TE)R | |
| (c) | Effluent contained prohibited substances | SD(TE)R | |
| (d) | Effluent contained certain substances more than the allowable limits | SD(TE)R | |

***The legislation printed in this guidebook is for information only. For the latest penalties for non-compliance, please visit the Singapore Statutes website at https://sso.agc.gov.sg.**

# 7 FREQUENTLY ASKED QUESTIONS

## DEFINITION

### Q1. What is trade effluent?

Trade effluent refers to any liquid, including particles of matter and other substances suspended in the liquid, which is the outflow from any trade, business or manufacture or of any works of engineering or building construction.

## DISCHARGING TRADE EFFLUENT INTO THE PUBLIC SEWERAGE SYSTEM

### Q2. Does the act apply to me?

If your company generates trade effluent intended for discharge into the public sewerage system, you will have to apply for a WA from PUB. The WA specifies the conditions you have to comply with, if you wish to discharge trade effluent into the public sewerage system.

You can apply online for a WA through the GoBusiness Licensing Portal at https://www.gobusiness.gov.sg. For more details on the WA application procedures and requirements, please refer to the PUB website at https://www.pub.gov.sg.

You are responsible for ensuring your trade effluent is collected and disposed of responsibly. Discharging trade effluent into the public sewerage system without PUB's approval constitutes a violation of the SDA and is illegal. As a business operator, you have a duty to ensure that any waste you generate is handled safely and in accordance with all environmental legislation.

### Q3. Is my WA valid for all the operations of my business?

The WA is valid for the business at the location that you have applied for. You need not re-apply for a new WA unless there is a change or addition to

(a) The process or operation used in the trade, manufacture or pre-treatment facilities, if any; or
(b) The layout of various units of plant and machinery used in the trade, manufacture, pre-treatment facilities or the quantity of the trade effluent discharging into the public sewerage system; or
(c) Major raw materials and chemicals to be used in the processes or operations,

which affects the amount, or the physical, organic, or chemical nature of the trade effluent discharged.

Scenarios which may affect your WA validity are listed below.

| Scenario | Action to Take |
|---|---|
| My factory has ceased operations | Inform PUB in writing to cancel the WA. Your WA will be cancelled and any deposit paid (applicable to those paying monthly trade effluent fees) will be refunded after settling all outstanding bills. |
| My factory has shifted to a new location | Inform PUB in writing of your new address and apply for a new WA. Provide an updated business registration certification from the Accounting & Corporate Regulatory Authority (ACRA). |
| My factory has changed its status e.g. from sole proprietor to private limited | Inform PUB in writing of your new status and apply for a new WA. Provide an updated business registration certification from ACRA. |
| My factory has changed its name | Inform PUB in writing of the change in name and attach a copy of the updated business registration certificate from ACRA. You need not apply for a new WA. |
| My factory is undergoing a change in trade activity which will increase the volume of trade effluent to be discharged | Inform PUB in writing of the new activity and the volume of trade effluent to be discharged. Provide a copy of the updated process diagram and other relevant documents e.g. chemical usage. PUB will assess if there is a need to apply for a new WA. |

### Q4. What kind of trade effluent can be discharged into the public sewerage system?

All trade effluent discharged into the public sewerage system shall meet the water quality criteria specified in the SD(TE)R under the following headings:

(a) Nature and type of trade effluent to be discharged,
(b) Trade effluent to be free of certain substances, and
(c) Maximum concentrations of certain substances.

For more details on the water quality requirements regarding trade effluent discharge into the public sewerage system, please refer to Annex D.

## SAMPLING LOCATION AND PARAMETERS

### Q5. Where should I collect trade effluent samples for analysis?

The trade effluent samples you collect for analysis should be representative of the treatment quality from your pre-treatment plant. Samples should be collected from the sampling tank or sump of the pre-treatment plant (see Figure 4).

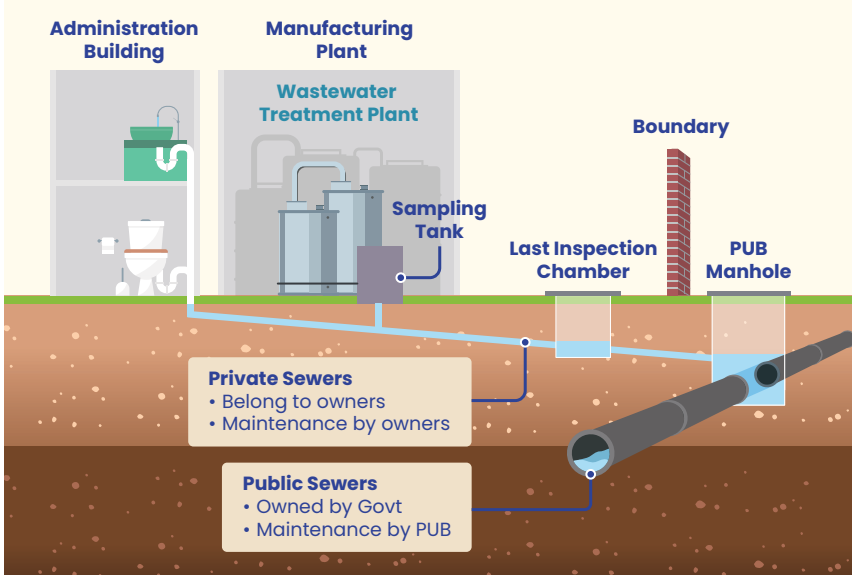



Figure 4: Sampling location

### Q6. What should I test for in the trade effluent sample?

The parameters or pollutants to test for depend on your specific trade. In general, you should test for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Suspended Solids (TSS) to understand the chemical and biological loadings of your trade effluent. You should also test for specific water quality parameters that are relevant for your trade. For instance, if you operate an electroplating facility that involves copper plating, you should test for heavy metals such as copper.

For the full list of parameters and discharge limits, please refer to the SD(TE)R available in the Singapore Statutes website at https://sso.agc.gov.sg.

### Q7. Whom can I send my sample to for 3rd party analysis?

You can send your samples to an accredited laboratory for analysis. For a list of accredited laboratories, please visit the Singapore Accreditation Council (SAC) website at https://www.sac-accreditation.gov.sg.

## TRADE EFFLUENT NOT MEETING DISCHARGE LIMITS

### Q8. What should I do if my trade effluent does not meet the requirements for discharge into the public sewerage system?

If you are unable to meet the water quality limits stipulated in the SD(TE)R, you can either:

(a) Install a wastewater treatment facility in your premises to pre-treat non-compliant trade effluent, ensuring water quality parameters meet discharge limits and prohibited substances are removed before discharging into the public sewerage system, or
(b) Engage a licensed waste collector, authorised by the National Environment Agency (NEA), to collect and dispose of your trade effluent off-site.

### Q9. What should I do if my company generates toxic industrial wastes?

The handling of toxic industrial wastes is regulated by the Environmental Public Health Act (EPHA), governed by the NEA. Under the EPHA, you need to engage a licensed toxic waste collector to collect and dispose of your toxic waste off-site. You should not engage a general waste collector to collect your toxic industrial waste. You will need to properly account for all your waste generation. You may also be required to declare your waste disposal through NEA's e-consignment system.

For more information on the proper handling of toxic industrial wastes, please refer to NEA's website at https://www.nea.gov.sg.

### Q10. If my trade effluent has BOD and TSS exceeding 400mg/L which I cannot treat, what can I do?

If you are unable to provide a wastewater treatment plant (e.g. due to space constraints) or engage a licensed waste collector to meet the discharge limits for BOD or TSS, you may apply for permission to discharge trade effluent

under the Trade Effluent Fee (TEF) Scheme. Under this scheme, upon approval from PUB, you will pay fees for discharging such trade effluent into the public sewerage system. The fees payable shall be in accordance with the scale set out in the SD(TE)R.

However, approval will not be granted for the discharge of trade effluent which contains:

(a) BOD greater than 6,000mg/L of the trade effluent, or
(b) TSS greater than 6,000mg/L of the trade effluent, or
(c) COD greater than 10,000mg/L of the trade effluent or three times the concentration of BOD in the trade effluent, whichever is the lower.

### Q11. What should I do if there is an accidental discharge of non-compliant trade effluent into the public sewerage system?

If you know of or suspect an accidental discharge or non-compliant trade effluent being discharged into the public sewerage system, please inform us immediately. This allows us to alert the WRPs of any incoming non-compliant trade effluent, enabling them to take necessary action. You can contact us through PUB-ONE, our 24-hour hotline, at 1800-CALL-PUB (1800-2255-782).

## GOOD PRACTICES FOR TRADE EFFLUENT MANAGEMENT

### Q12. What measures can I take to prevent discharging non-compliant trade effluent into the public sewerage system?

You can follow the measures indicated in Annex C to prevent discharging non-compliant trade effluent into the public sewerage system.

### Q13. How can maintenance and process monitoring schedules for the wastewater treatment plant help me?

**Maintenance Schedule**

If you have a pre-treatment plant in your facility, a maintenance schedule is essential to ensure its proper operation and adequate treatment of your trade effluent. Refer to your operation manuals or contact your consultant, vendor or contractor to develop a comprehensive inspection and maintenance schedule.

Here are some useful pointers:

(a) Keep proper records of the mechanical components (such as pumps and stirrers) used in the plant.
(b) Implement a regular servicing schedule, including thorough inspection of equipment and replacement of consumable parts.
(c) Keep all servicing and calibration records for process instruments used in the plant.

**Process Monitoring Schedule**

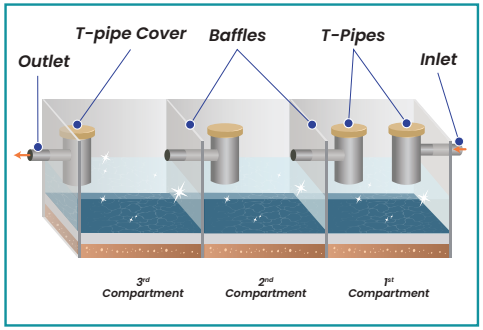
A process monitoring schedule, combined with a maintenance schedule, effectively monitors the performance of your treatment process.

Here are some useful pointers:

(a) Implement a regular schedule to collect trade effluent samples from the plant and verify compliance with discharge limits stipulated in the SD(TE)R. You may use commercially available analytical kits and sensors for measuring water parameters to test your effluent samples.
(b) Periodically collect and send trade effluent samples to an external accredited laboratory for analysis.
(c) Maintain records of all test results, monitor for process trends, and revise the monitoring schedule accordingly.

### Q14. What are some good practices that can be adopted in maintaining oil interceptors?

An oil interceptor is a device that separates oil and grease from trade effluent. Oil interceptors are crucial as they minimise the amount of oil and grease entering the public sewerage system, thereby reducing the risk of sewer blockages. Figure 5 illustrates a typical oil interceptor.




How oil interceptor works:

(a) Trade effluent containing oil and grease enters the oil interceptor through the inlet.
(b) Oil and grease are separated from the effluent as the effluent flows through each compartment.
(c) Trade effluent with minimal amount of oil and grease exits the oil interceptor through the outlet.

Figure 5: Cross-section of a typical oil interceptor

Here are some useful pointers:

**(i) Implement a maintenance schedule**

An oil interceptor requires regular maintenance to ensure it continues to treat trade effluent effectively. Implement a maintenance schedule that includes regular checks for:

(a) Excessive build-up of scum and debris that may get carried into the public sewerage system,
(b) Accumulation of oil stains on the interceptor walls, and
(c) Sufficient water level in the interceptor.

**(ii) Implement a monitoring schedule**

You are required to implement a monitoring schedule to regularly check the quality of the trade effluent discharged from oil interceptors. Consider the following:

(a) Collect trade effluent samples from the interceptor outlet and send them to accredited laboratories for two tests: "Oil-and-Grease (Total)" and "Oil-and-Grease (Hydrocarbon)".
(b) If you operate a motor workshop or trade involving industrial solvents such as metal degreasers, you are also encouraged to send trade effluent samples for Gas Chromatographic Mass Spectrometry (GCMS) analysis to test for inflammable substances.

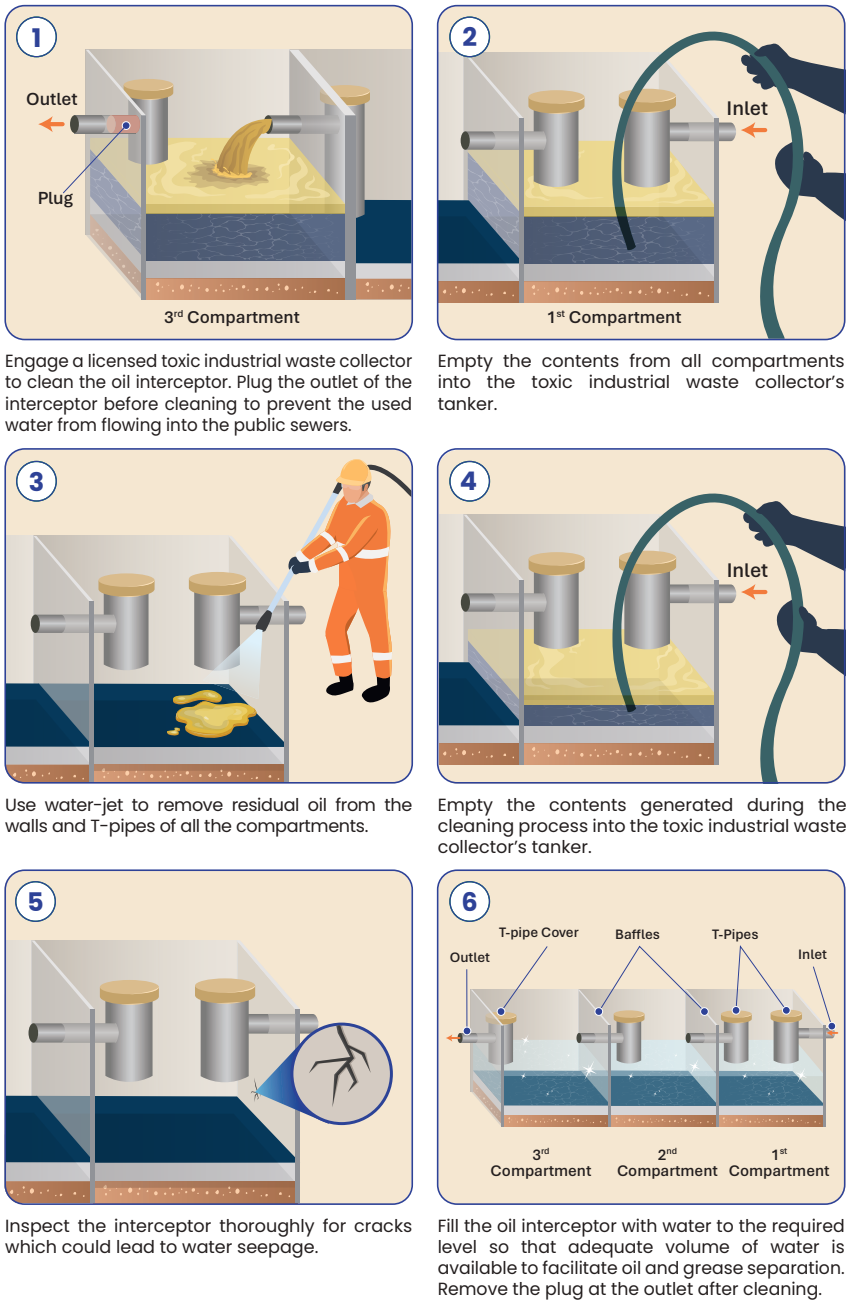
Use these laboratory test results to review and adjust your oil interceptor maintenance schedule as needed.

**(iii) Clean the oil interceptor regularly**

Oil interceptor needs to be cleaned regularly. The recommended steps for cleaning oil interceptor are illustrated in Figure 6.

**(iv) Collection, transportation, and disposal of toxic wastes**

The collection, transportation and disposal of toxic wastes, including waste oil and spent solvents, are regulated by the Environmental Public Health (Toxic Industrial Waste) Regulations, administered by NEA. You are to consult NEA for guidance on the proper collection, transportation and disposal of waste oil and spent solvents.




Engage a licensed toxic industrial waste collector to clean the oil interceptor. Plug the outlet of the interceptor before cleaning to prevent the used water from flowing into the public sewers.

Empty the contents from all compartments into the toxic industrial waste collector's tanker.

Use water-jet to remove residual oil from the walls and T-pipes of all the compartments.

Empty the contents generated during the cleaning process into the toxic industrial waste collector's tanker.

Inspect the interceptor thoroughly for cracks which could lead to water seepage.

Fill the oil interceptor with water to the required level so that adequate volume of water is available to facilitate oil and grease separation. Remove the plug at the outlet after cleaning.

Figure 6: Steps in maintaining an oil interceptor

## OTHER INFORMATION

### Q15. What if I want to discharge my trade effluent into the open drains?

The discharge of effluent into the watercourse (e.g. open drains, canals and rivers) is regulated under the Environmental Protection and Management Act (EPMA) and the Environmental Protection and Management (Trade Effluent) Regulations. These are administered by the NEA. For more information, you may visit NEA's website at https://www.nea.gov.sg.

## 8 CONTACT US

For enquiries on discharge of trade effluent into the public sewerage system, you may contact PUB-ONE (24-hour hotline) at 1800-CALL-PUB (1800-2255-782).

For more information on WA, or to request for posters on educating and reminding your staff about good practices in managing chemicals at the workplace, please email us at PUB_WA@pub.gov.sg.

To read the legislation in detail, you may visit the Singapore Statutes website at https://sso.agc.gov.sg.

## ANNEX A – USED WATER TREATMENT PROCESS

Used water from both domestic and non-domestic sources is collected via the public sewerage system and treated at our WRPs. The treated used water is further purified for reuse as NEWater or discharged into the sea.

Figure 7: Schematic of used water treatment process

### Liquid Treatment

**Preliminary Treatment**

The preliminary treatment process removes the debris and sandy materials from the used water. The used water that arrives at the WRP is first lifted up to a higher elevation by pumps. With the help of gravity, the used water flows through the various treatment tanks and automated mechanical screens to remove the debris. This is followed by grit settling tanks or vortex grit chambers to settle and remove the heavier sandy materials present in the used water.

## Primary Treatment

The used water, now free of debris and sandy materials, flows through very slowly across large tanks called primary clarifiers (Figure 8). This process allows the solid pollutants suspended in the used water to settle to the bottom of the tank. The settled solids known as primary sludge, are collected by scrapers at the bottom of the tanks and removed regularly for treatment. Additionally, light materials like scum and greasy materials float up to the surface of the tank, and is collected and combined with the sludge for further treatment. The top layer of water, which contains much less pollutants in suspension, leaves the primary clarifiers for secondary treatment.

Figure 8:
Primary Clarifier

## Secondary Treatment

The conventional activated sludge process comprises the aeration tanks (bioreactors) (Figure 9) and final clarifiers (Figure 10). The used water is mixed with a culture of micro-organism known as activated sludge in the bioreactor. The micro-organism absorbs and breaks down the organic pollutants in the used water. In order to sustain the biological activities in the bioreactor, a certain level of dissolved oxygen has to be maintained in the used water. This is achieved by blowing air through air diffusers to create fine air bubbles in the aeration tank. The aeration process also helps to mix the used water with the micro-organism to promote the biological reaction process. By the time the used water reaches the end of the aeration tanks, most of the pollutants would have been absorbed by the micro-organism. The mixture of micro-organism and the treated water is then channelled into the final clarifiers.

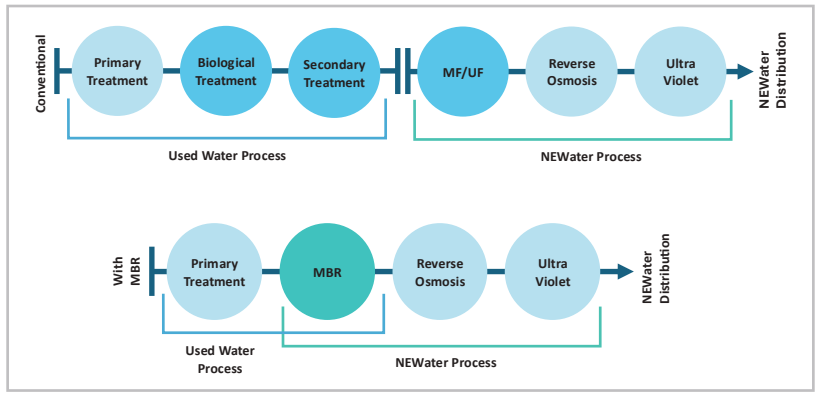
Figure 9:
Aeration Tank

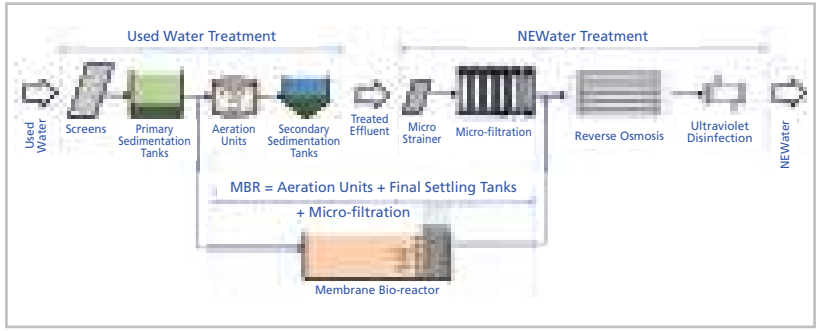
At the final clarifiers, the activated sludge settles to the bottom of the tanks. The clear supernatant water at the top of the tank is collected and discharged from the tanks as final effluent. The sludge which settles to the bottom is constantly drawn out. A portion of the drawn sludge is returned back into the aeration tanks to maintain a desired concentration of micro-organism in the tank to sustain the optimal bio-reaction process. The excess activated sludge is sent for further treatment.

Figure 10:
Final Clarifier

Since 2006, PUB has been adopting the membrane bioreactor (MBR) (Figure 11) technology for water reclamation in Singapore. MBR is a 3-in-1 solution that combines conventional bioreactors, secondary sedimentation tanks and microfiltration/ultrafiltration (MF/UF) in one single step (Figures 12a and 12b).

Figure 11:
Membrane
Bioreactor Tank




Figures 12a (top) & 12b (bottom): MBR combines conventional bioreactors, secondary sedimentation tanks and MF/UF in one single step.

## Final Effluent

The final effluent meets the discharge standards of 20 mg/l BOD and 30 mg/l TSS. The final effluent is further treated using advanced membrane technologies to high grade NEWater. Part of the final effluent is also further treated to industrial water which is supplied to the industries in Jurong Island. The excess final effluent is discharged to sea.

## Solid Treatment

### Sludge Thickening

Raw sludge collected from the primary sedimentation tanks and excess activated sludge collected from the secondary treatment process contain a high percentage of water. The water content of the sludge is reduced through a thickening process, e.g. thickening centrifuges (Figure 13), and the thickened sludge is fed into anaerobic sludge digesters for further treatment.

Figure 13:
Thickening Centrifuge

### Sludge Digestion

In the digesters (Figure 14), another culture of micro-organism thriving in an oxygen-deficient environment breaks down the organic substances in the sludge. The sludge is allowed to remain in the digesters for 20 - 30 days. The digestion process converts the organic matter into biogas which contains 60 - 70% methane. The biogas is then sent to biogas engines to generate electricity. The electricity produced is used to offset the energy consumption of the WRPs.

Figure 14:
Digester

### Sludge De-watering

The digested sludge is dewatered to further reduce the water content to facilitate handling for final disposal. The physical process of dewatering can be performed by a dewatering centifuge (Figure 15). The dewatered sludge is then disposed of for incineration.

Figure 15:
Dewatering Centrifuge

### Sludge Dryers

In some WRPs, dewatered sludge is further dried with the use of sludge dryers for the ease of disposal. The dryers, which are powered by biogas, dries the sludge into granulate particles before incineration.

### Greasy Waste Treatment

PUB also treats greasy waste collected from eateries and food industries. Grease traps installed at various locations throughout Singapore pre-treat culinary waste by removing the oil and grease before discharge into sewers. Licensed collectors maintain these grease traps and transport the collected greasy waste to WRP for treatment.

# ANNEX B – NEWATER PRODUCTION PROCESS

The NEWater process recycles our treated used water into ultra-clean, high-grade reclaimed water, cushioning our water supply against dry weather and enhancing Singapore's water sustainability.

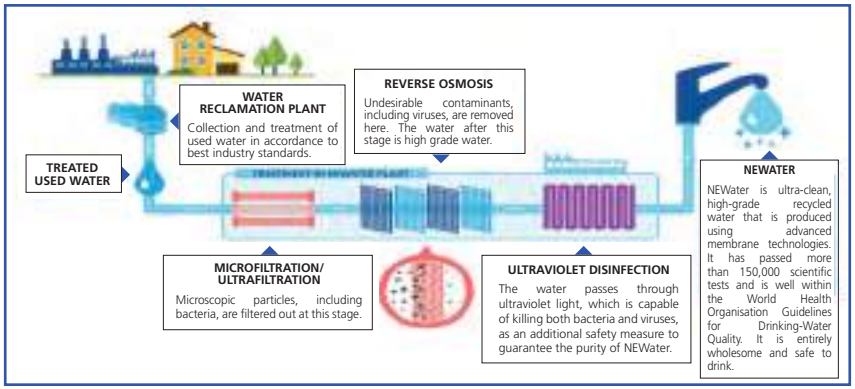



Figure 16: NEWater Production Process Schematic

### Microfiltration / Ultrafiltration

The first stage of the NEWater production process is known as MF or UF. In this process, the treated used water is passed through membranes to filter out microscopic particles and bacteria.

PUB has been adopting the MBR technology for water reclamation. MBR is a 3-in-1 solution that combines conventional bioreactors, secondary sedimentation tanks and MF/UF in one single step. Hence, the MF/UF process can be replaced by the single-step MBR process, where applicable.

### Reverse Osmosis

The second stage of the NEWater production process is known as Reverse Osmosis (RO), where a semi-permeable membrane with very small pores is used. This allows water molecules to pass through while leaving contaminants, such as viruses, bacteria, heavy metals, aromatic hydrocarbons, pesticides, etc., behind.

### Ultraviolet Disinfection

After the RO stage, the water is already of a high-grade quality. The third stage of the NEWater production process is Ultraviolet (UV) Disinfection which inactivates any last traces of bacteria and viruses. This process acts as an additional safety measure to guarantee the purity of NEWater.

# ANNEX C – GOOD PRACTICES IN MANAGING TRADE EFFLUENT DISCHARGE INTO THE PUBLIC SEWERAGE SYSTEM

**Housekeeping and Proper Storage of Chemicals**

- Store and handle raw materials, wastes, chemicals, and fuels responsibly to prevent them from entering sanitary drain lines, floor traps and sewers in your premises.
- If you use chemicals and industrial solvents in your premises, obtain Safety Data Sheets (SDS) from the chemical suppliers. These SDS provide essential information, including chemical composition and instructions for proper disposal of spent chemicals.
- When storing chemicals and solvents in your premises, provide proper containment facilities such as metal trays or bund walls around storage areas to prevent accidental leakage or spillage into the public sewerage system and drain lines.
- Store materials such as grease, paints, detergents, metals and raw materials in appropriate, labelled containers. All outdoor storage containers must have lids and the lids should be properly closed. Keep stockpiled materials protected from rain by storing them inside buildings, under roofs, or covered with tarpaulins.

**Process Monitoring**

- Maintain an up-to-date sanitary drainage plan that clearly identifies the locations and flows of all existing drains and sewers around your premises.
- Ensure proper maintenance of pre-treatment plants and water quality monitoring sensors (if installed) to maintain optimal functionality.
- Clearly demarcate discharge points for spent solvents and train workers on these locations to ensure proper collection and disposal by licensed waste collectors. When discharging trade effluent, verify that connection is made to the correct system.
- Explore possibilities for using alternative materials and practices to reduce effluent contamination.

**Maintenance Work**

- Conduct maintenance work on equipment and vehicles in designated or covered areas where used water can be collected and disposed of separately. Use drip pans to collect leaks or spills during maintenance activities. The collected liquid shall be disposed of by licensed waste collectors.

**Emergency Preparedness and Response**

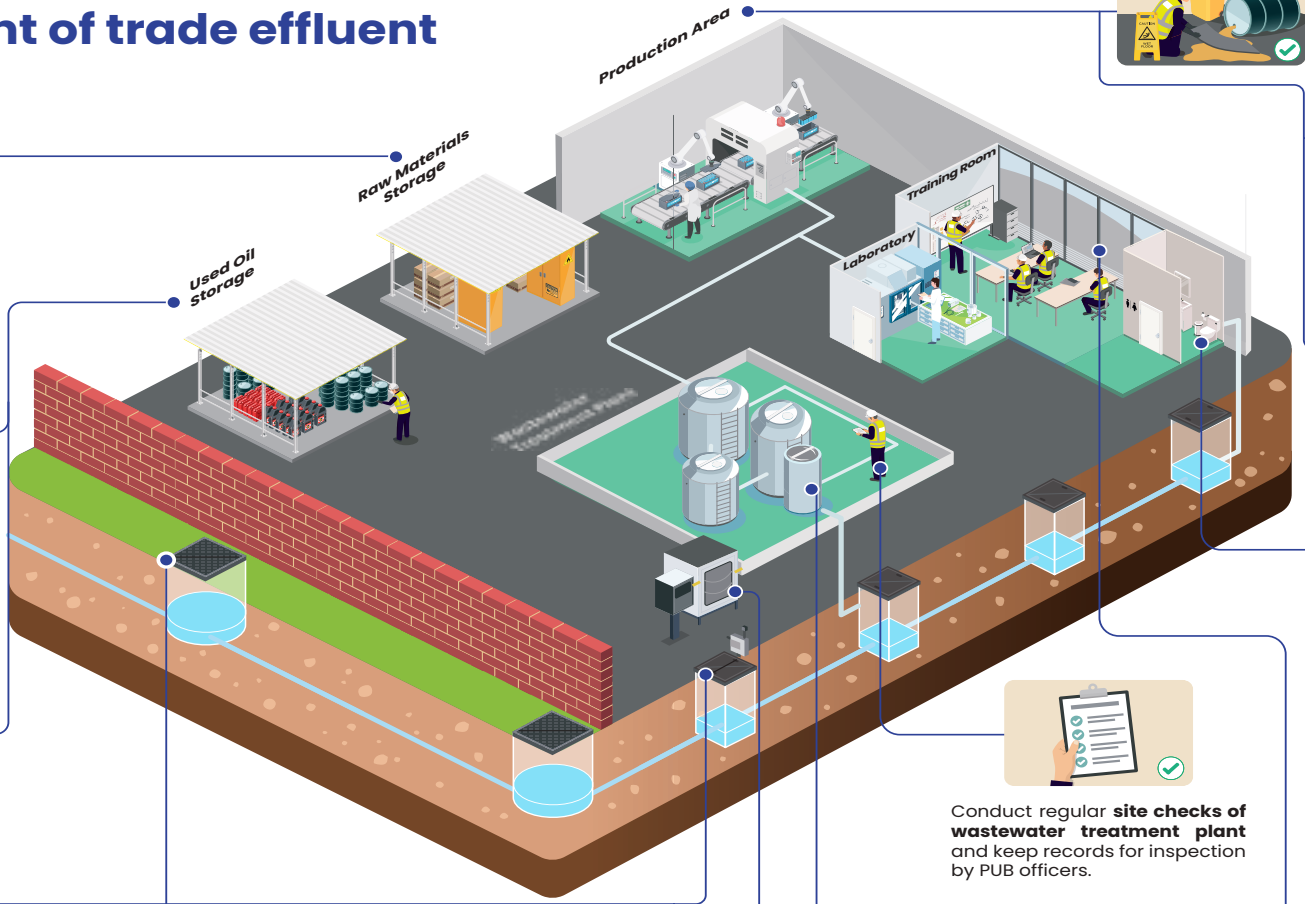
- Keep spill kits or absorbent materials (e.g. granules, sawdust) readily available at locations where there is a risk of spillage or leakage of pollutants into the public sewerage system. Ensure employees know their locations and how to use them.
- Never wash spilled chemicals into sewers or drains. Use absorbent, spill kits, paper wipes or rags to clean spills, and dispose of them as solid waste. Do not wash rags for reuse.

**Educate Employees and Contractors**

- Conduct regular briefings and in-house training for workers and contractors on proper procedures for handling, disposing and discharging of liquid wastes.

More good practices in managing trade effluent discharge into the public sewerage system are illustrated in Figure 17.

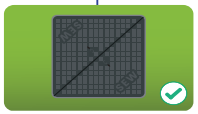
# Guidelines to effective management of trade effluent



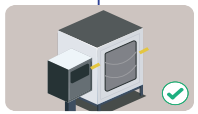

**Ensure proper storage of materials and compliance** with relevant requirements by authorities (e.g SCDF, NEA), especially for flammable or hazardous materials.

Engage a NEA-licensed toxic industrial waste collector to **dispose of toxic industrial waste** e.g. used oil and spent chemicals. List of NEA's Licensed Toxic Industrial Waste Collectors is available at www.NEA.gov.sg.

**Store used oil and spent chemicals in containers** and engage a NEA-licensed toxic waste collector for disposal.



Ensure manhole and last inspection chamber are closed **at all times**.



Ensure monitoring system are **locked at all times and not tampered with**.

Conduct monthly **sampling and laboratory analysis** of treated trade effluent. Keep analysis reports of treated trade effluent and produce them when asked by PUB officers.



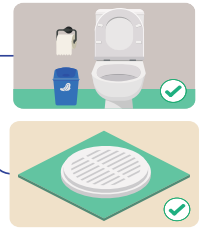
Conduct regular **site checks of wastewater treatment plant** and keep records for inspection by PUB officers.

Conduct **regular toolbox meetings and trainings** on proper disposal of chemical wastes.

Use **absorbent kits** to contain any spillage and do not wash chemicals or diesel leaks into sewers.

Provide a **proper washing area** for materials.

Ensure **proper containment** of flammable materials.



Ensure trade effluent, used oil, spent chemicals and other industrial wastes **are not disposed of into the toilets, floor traps and other inspection chambers in the premise**.


Maintain **proper documentation** e.g. Written Approval for Trade Effluent Discharge into Public Sewers.

Figure 17: Good Practices in Managing Trade Effluent Discharge into the Public Sewerage System

# ANNEX D – WATER QUALITY REQUIREMENTS FOR TRADE EFFLUENT DISCHARGE INTO THE PUBLIC SEWERAGE SYSTEM

All trade effluent discharged into the public sewerage system shall comply with the discharge limits stipulated in the SD(TE)R at all times.

**For the latest list of parameters and their corresponding discharge limits, refer to the SD(TE)R Regulations available in the Singapore Statutes website at https://sso.agc.gov.sg.**

## (I) DISCHARGE LIMITS OF CERTAIN SUBSTANCES

The physical and chemical characteristics of the trade effluent **shall not exceed the following limits** at the point of its entry into the public sewerage system:

(a) Temperature shall not exceed 45° Celsius
(b) pH shall not be less than 6 nor more than 9
(c) Caustic alkalinity shall not be more than 2,000 milligrams of calcium carbonate per litre

| Maximum Concentrations of Certain Substances in Trade Effluent | | | |
|---|---|---|---|
| 1 | 5 Day Biochemical Oxygen Demand ($BOD_5$) at 20°C | 11 | Grease and Oil (Non-hydrocarbon) |
| 2 | Chemical Oxygen Demand (COD) | 12 | Arsenic |
| 3 | Total Suspended Solids (TSS) | 13 | Barium |
| 4 | Total Dissolved Solids (TDS) | 14 | Tin |
| 5 | Chloride (as chloride ion) | 15 | Iron (as Fe) |
| 6 | Sulphate (as $SO_4$) | 16 | Beryllium |
| 7 | Sulphide (as sulphur) | 17 | Boron |
| 8 | Cyanide (as CN) | 18 | Manganese |
| 9 | Detergents (linear alkylate sulphonate as methylene blue active substances) | 19 | Phenolic Compounds (expressed as phenol) |
| 10 | Grease and Oil (Hydrocarbon) | 20 | Fluoride (expressed as fluoride ion) |

List is as of September 2025

| Maximum Concentrations of Metals in Trade Effluent | | | |
|---|---|---|---|
| 1 | Cadmium | 6 | Nickel |
| 2 | Chromium (trivalent and hexavalent) | 7 | Selenium |
| 3 | Copper | 8 | Silver |
| 4 | Lead | 9 | Zinc |
| 5 | Mercury | | |

Note: Where 2 or more of the metals listed in the table are present in the trade effluent, the total concentration of the metals shall not exceed 10 milligrams per litre.

List is as of September 2025

## (II) SUBSTANCES NOT TO BE DISCHARGED

Trade effluent discharged into the public sewerage system shall not contain any of the following substances that is listed in the SD(TE)R.

| | |
|---|---|
| 1 | Any toxic industrial waste, unless the toxic industrial waste is treated and does not contain any substance listed in the Second or Third Schedule in a concentration greater than that specified in either Schedule for the substance |
| 2 | Calcium carbide |
| 3 | Petroleum spirit or other inflammable substance |
| 4 | Any organic compound specified in the First Schedule |
| 5 | Any substance that either by itself or in combination or by reaction with other waste or refuse may give rise to any gas, fume, odour or substance which is or is likely to be a hazard to human life, a public nuisance, injurious or otherwise objectionable, or which prevents or is likely to prevent entry by workmen maintaining or repairing the public sewerage system, into the public sewerage system |
| 6 | Yeast, spent or unspent molasses, crude tar, tar oil, crude oil, carbon disulphide, hydro-sulphide and poly-sulphide |
| 7 | Any radioactive material |
| 8 | Any waste or refuse liable to form a viscous or solid coating or deposit on any part of the public sewer or sewerage system |
| 9 | Any excessively discolouring substance |
| 10 | Any pesticide, fungicide, herbicide, insecticide, rodenticide or fumigant |
| 11 | Blood waste |
| 12 | Infectious waste |
| 13 | Any biological agent within the meaning given by section 2 of the Biological Agents and Toxins Act |
| 14 | Any toxin within the meaning given by section 2 of the Biological Agents and Toxins Act |
| 15 | Any animal waste, except in accordance with paragraph (2) of Regulation 9 |
| 16 | Any chemical that is classified with hazard statement code H340, H350 or H360 under the ninth revised edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) published by the United Nations |
| 17 | Any waste generated from a process that involves tissue digestion or tissue hydrolysis. |

List is as of September 2025

## (III) LIST OF PROHIBITED ORGANIC COMPOUNDS GAZETTED IN THE FIRST SCHEDULE

| List of prohibited organic compounds | | | |
|---|---|---|---|
| 1 | Methylene Chloride | 18 | Furan |
| 2 | Trichloroethylene | 19 | THF (Tetrahydrofuran) |
| 3 | 111-trichloroethane | 20 | DMF<br>(N, N-Dimethylformamide) |
| 4 | Tetra-chloromethane | 21 | Benzene |
| 5 | 112-Trichloroethane | 22 | Turpentine |
| 6 | Toluene | 23 | Polybrominated Diphenyl Ether |
| 7 | Styrene | 24 | Isobutanol |
| 8 | Methyl tert-butyl-ether | 25 | Methyl Ethyl Ketone |
| 9 | Nonane | 26 | Methyl Isobutyl Ketone |
| 10 | Decane | 27 | Isopropyl ether |
| 11 | Tetrachloroethylene | 28 | Diethyl ether |
| 12 | Ethylbenzene | 29 | Dimethyl Sulphide |
| 13 | Xylene (o, m, p) | 30 | Dimethyl Sulphoxide |
| 14 | Hexane | 31 | Cresol (o, m, p) |
| 15 | Heptane | 32 | Cyclopentanone |
| 16 | Octane | 33 | DMAc<br>(N, N-Dimethylacetamide) |
| 17 | 1,2,4-Trimethylbenzene | | |
| List is as of September 2025 | | | |