

MANAGEMENT OF TOXIC INDUSTRIAL WASTE IN SINGAPORE

1 Introduction

- 1.1 Wastes may be defined as materials which no longer can be used for the purposes they were intended for originally. Toxic industrial waste (TIW) is waste which by their nature and quality may be potentially detrimental to human health and/or the environment and which require special management, treatment and disposal.
- 1.2 In view of Singapore's small land area with limited land and water resources, the siting of industries are carefully planned and managed. In addition, industries are required to design their manufacturing processes and provide adequate pollution control facilities to comply with pollution control requirements on emission of air pollutants, discharge of industrial effluent, management of hazardous substances and waste.
- 1.3 Many companies in Singapore currently handle or use hazardous chemicals. The use of these chemicals generates a variety of TIW. The main types of TIW are spent acids, spent solvents, spent etchants, waste oil and waste sludge.

2 Strategy for Control of Toxic Industrial Waste

- 2.1 The key elements in Singapore's strategy to control TIW and ensure their safe treatment and disposal are as follows:
 - (i) avoid and reduce generation of intractable wastes;
 - (ii) regulate the management of TIW ;
 - (iii) monitor and audit management of TIW ; and
 - (iv) promote and support educational programmes.
- 2.2 All new industrial developments are screened by the National Environment Agency (NEA) at the planning stage. One of the key areas checked in this screening process is the generation and disposal of wastes from proposed industrial developments. NEA would approve the proposed industrial development only if the wastes generated could be safely treated and disposed of in Singapore.

- 2.3 In addition, NEA will require industries to use processes that minimise overall waste generation or facilitates the reuse, recovery and recycling of the wastes. Industries also need to incorporate measures into the design of their facilities to ensure wastes generated are handled and managed properly. The adequacy of pollution control equipment, such as flue gas scrubbers, is checked to ensure these industries are operating optimally to prevent pollution. These measures incorporated into the design of the plants are checked at the planning stage.
- 2.4 NEA has encouraged the setting up of specialised waste recycling, treatment, and disposal plants. There are currently about 200 such plants in Singapore that are able to receive and treat a wide range of TIW.
- 2.5 The setting up of TIW recycling, treatment and disposal plants serve to help industries, especially the smaller companies, which may generate small quantities of TIW but find it impractical or uneconomical to install, operate and maintain their own treatment facility due to cost, lack of expertise or space constraint.
- 2.6 The collection, recycling, treatment and disposal of toxic industrial waste are controlled under the Environmental Public Health Act (EPHA) and the Environmental Public Health (Toxic Industrial Waste) Regulations (EPH(TIW)Regs).

3 The Environmental Public Health (Toxic Industrial Waste) Regulations (EPH(TIW)Regs)

- 3.1 The control on the import, sale, supply, receipt, transport, treatment and disposal of TIW are regulated under the Environmental Public Health (Toxic Industrial Waste) Regulations (“EPH(TIW)Regs”). TIW controlled under the EPH(TIW)Regs are listed in the Schedule of the Regulations as waste streams from specific industrial activities, wastes containing specified toxic components and as specific categories of wastes. The list includes spent acids, alkalis, wastes containing gallium arsenide, spent etching solutions containing copper from printed circuit board manufacturing, etc. The list can be found in the Schedule to the EPH(TIW)Regs.

- 3.2 In order to facilitate controls and proper management, the functions and responsibilities of key persons involved in handling TIW are clearly written in the EPH(TIW)Regs. The key persons include the following:
- (a) Generator of wastes
 - (b) Toxic Industrial Waste Collector (TIWC)
 - (c) Carrier or transporter
- 3.3 The generator will have to treat the wastes in an approved in-house treatment plant and dispose of the solid residues, if any, at NEA's approved landfill site. Alternatively, the generator can engage a licensed toxic industrial waste collector to collect his wastes for treatment and disposal. For more information regarding the safe management and handling of toxic industrial waste, both toxic industrial waste collector and generator shall take guidance from the latest edition of Singapore Standard SS603 Code of Practice for Hazardous Waste Management.
- 3.4 A toxic industrial waste collector (TIWC) is a person who receives toxic or accepts any toxic industrial waste for storage, reprocessing, usage, treatment or disposal. He is required to obtain a licence from NEA to collect specific TIW. A TIWC is confined to the list of TIW that he is approved to collect as listed in his licence. The storage and treatment activities shall be carried out only in the approved premises and facilities.
- 3.5 Written transport approval from NEA is also required for the transportation of wastes in quantities which exceed those specified in the EPH(TIW)Regs. The responsibilities of the following key persons in the transportation are clearly defined in the EPH(TIW)Regs:
- (a) **Consignor** - the person who presents a consignment of TIW for transport. The consignor can include the generator. Transport approval shall be obtained from NEA to transport the waste.
 - (b) **Carrier** - the person who undertakes the transport of the TIW. He can either be the generator, the licensed collector or the transport company engaged by either one of them.
 - (c) **Consignee** - the person who receives the TIW. He is usually the TIWC.
- 3.6 To prevent illegal dumping and disposal of toxic industrial waste, the movement of every consignment of TIW from a generator through a

carrier to a collector is tracked by electronic submission of consignment note under the Waste and Resource Management System (WRMS).

4 Monitoring and Enforcement

- 4.1 Monitoring and enforcement will ensure that persons, companies or TIWCs that contravene the EPH(TIW) Regulations are penalised accordingly and also deter complacency in waste management.
- 4.2 Routine inspections are conducted on premises of TIWCs to ensure requirements on collection, storage, treatment, and disposal of toxic industrial waste are complied with. Audit records of TIW collected, treated and disposed of are checked for compliance.

5 Partnership and Education

- 5.1 In addition to regulatory controls, the co-operation of industries in ensuring that toxic industrial waste is properly managed and disposed of in Singapore is essential. NEA will continue to work with the industry and relevant stakeholders in promoting better management and disposal of toxic industrial waste through joint research and educational programmes.
- 5.2 NEA conducts regular discussions and dialogue sessions with academia, companies and industry associations to seek advice on industry best practices for TIW management, and also garner feedback on challenges that they face. NEA also keeps relevant industries informed on changes in legislation or multilateral environmental agreements that would have impact on existing or planned approaches to TIW management in Singapore.

6 Minimising of TIW residues to landfill

- 6.1 The estimated amount of TIW collected by TIWCs annually are tabulated below:

Type of TIW	2018	2019	2020	2021	2022	2023
Oily Sludge	24	20	32	34	49	28
Waste Chemicals	539	447	359	323	440	454
Biohazardous waste	5	4	6	8	7	6
Note: Weight are measured in '000 tonnes.						

The treatment of TIW results in the generation of TIW residues, where such residues generally consist of solid waste produced from various processes such as incineration (e.g. bottom ash and fly ash), wastewater treatment (e.g. sludge waste from filters) and fixation. These solid TIW residues must meet the landfill acceptance criteria (i.e. Toxicity Leaching Acceptance Parameters (TCLP)) before they are disposed of at Singapore's only landfill, Semakau Landfill.

- 6.2** In order to extend the lifespan of our landfill, NEA encourages TIW generators to reduce the amount of TIW they produce, and TIWCs to reduce the amount of TIW residues to be disposed of. Many TIW generators, TIWCs and research institutes are constantly carrying out research and development work to find ways to recover TIW and reduce the generation of TIW residues. There are also available government-funded grants which companies can tap on to aid their research and development efforts.

7 Transboundary Movements of Hazardous Wastes

- 7.1** Singapore is a Party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention) since 2 Jan 1996. The Convention aims to protect human health from the generation, transboundary movements and management of hazardous waste as defined under the Convention.
- 7.2** Singapore enacted the Hazardous Waste (Control of Export, Import and Transit) Act and its Regulations on 16 Mar 1998 to strengthen the control on export, import and transit of hazardous waste in accordance with the principles and provisions of the Basel Convention. Under the Hazardous Waste (Control of Export, Import and Transit) Act and its Regulations, any person who wishes to export, import or transit hazardous waste shall obtain a permit from NEA. The Prior Informed Consent (PIC) procedure

of the Basel Convention is adopted in granting any permit for the export, import or transit of hazardous waste.

- 7.3 One of the key objectives of the Convention is to minimise the transboundary movements of hazardous wastes and other wastes that are covered under the scope of the Convention. As such, any waste generated in Singapore should, as far as possible, be treated or recycled at local facilities before it can be considered for export to an overseas facility for treatment.
- 7.4 NEA will continue to participate in international events on the Basel Convention and adopt the principles of Basel Convention in dealing with transboundary movements of hazardous wastes defined under the Convention

8 Conclusion

8.1 NEA will continue monitoring the compliance of companies in Singapore to ensure TIW is managed in a safe and environmentally responsible manner. TIW generators and TIWCs are also encouraged to adopt best practices to minimise the generation of TIW to preserve the lifespan of our landfill.