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GOVERNMENT OF DUBAI

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Dubai Municipality

Technical Guidelines on Battery Recycling

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Waste Strategy and Projects Department
Dubai Municipality

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1.0	22/08/2024	Ammar Kamil Mohammed Saeed	
1.0	22/08/2024	Wafa A.Yousef Hanoun	

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Waste Strategy and Project department			
1.0		Mohammed Iqbal Alkhalsan	
1.0		Ali Abdulla Yousuf Al Jaroodi	

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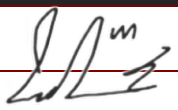
1.0		Waste Strategy and Project Department Head	

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LIST OF ABBREVIATIONS & DEFINITIONS

AESEAS	Environment Sustainability and Environmental Assessment Section
CEN	European Committee for Standardization
DET	Department of Economy & Tourism
DM	Dubai Municipality
EC	Environmental Clearance
EIAC	Emirates International Accreditation Centre
EPR	Extended Producer Responsibility
EWC	European Waste Catalogue
HMP	Hazard Management Plan
NOC	No Objection Certificate
OHSMS	Occupational Health and Safety Management System
PPE	Personal Protective Equipment
SCR	Selective Catalytic Reduction
TCLP	Toxicity Characteristic Leaching Procedure
VOC	Volatile Organic Compounds
WDS	Waste Disposal Service
WSPD	Waste Strategy and Projects Department
WTS	Waste Treatment Section
Disposal	Refers to any or combination of the following means or processes where waste is subjected to or rendered for: • Direct tipping into landfill; • Incineration, burning or combustion in a controlled manner for the purpose of getting rid of waste material; • Final deposit at any DM waste treatment complex or landfill; The process of segregation and recovery of the materials for the purpose of recycling or reuse is not considered a disposal
Difficult Waste	The non-hazardous material requires special handling to avoid any unacceptable annoyance or environmental impact.
Disposal Site	The site with defined area and boundaries is intended as the final depository of waste. It may be a final depository site of a lined or unlined landfill or any dedicated facility for waste treatment. In the case of waste intended for export, the name of the receiving state or locality shall be referred to as the disposal site.
Emirates International Accreditation Centre[1]	The competent authority responsible for the accreditation of private company laboratories for environmental testing
Environmental Standards	Within the context of this document and pursuant to the Local Order on the Environment Protection Regulations in the Emirate of Dubai, are the specified values of environment quality indicators or allowable limit of pollutants in the waste stream when discharged into a segment of the environment, beyond which, it can cause pollution and impair the quality of the environment.
Hazardous Materials	Solid, liquid, or gas materials hazardous to mankind's health severely affect the environment, such as toxic explosives, and flammable or ionized radiation materials.

[1] Previously **D**ubai **A**ccreditation **C**entre

Non-hazardous waste	is a waste or mixture of wastes that does not pose a substantial threat to public health or the environment and is safer to handle, store, and dispose of compared to hazardous waste. However, it can be harmful to the environment if left untreated. This category includes everyday household items like food waste, paper, cardboard, plastics, glass, metals, and textiles, as well as non-toxic industrial waste, uncontaminated construction and demolition debris, organic waste like yard trimmings and agricultural residues, and certain electronic waste.
Hazardous waste	A waste or a mixture of wastes containing one or more properties of a hazardous substance, i.e., being toxic, infectious, corrosive, flammable, oxidizing, radioactive, reactive, or explosive which, at certain concentration or conditions and improper handling, can cause substantial harm to human, properties or the environment.
Landfill	An area generally used for the disposal of solid wastes by burial. It is either an ordinary unlined landfill or an engineered landfill with basal lining of an impervious material and fitted with a leachate collection system
RASID	Dubai Municipality has introduced the RASID waste management monitoring system to regulate operations of registered waste management companies by streamlining and monitoring waste management transportation and associated activities – from collection through transit and till disposal, from analysis review to end-user solutions and by controlling illegal and unauthorized dumping practices.
Sludge	Solid waste or granular waste at spadable consistency with no free liquid which has been obtained from the treatment of waste or process refuse from a commercial or industrial operation.
Trade Wastewater	Non-hazardous wastewater generated and discharged from industrial operations or commercial other than domestic wastewater.
UN Number	United Nations Number assigned to any dangerous goods by the UN Committee of Experts on the Transport of Dangerous Goods and as published in the current edition of the UN Recommendations, IMDG Code, ICAO Rules or IATA Regulations
Unwanted material	Any material/goods declared by their owner to be unwanted and require disposal, or of which a decision for their destruction/ disposal is issued by a competent authority, or that proper disposal requires special care
Treatment (of waste)	An induced change, normally carried out in a treatment facility, in the physical or chemical composition of the waste so as to make it less hazardous, less in volume, and acceptable for final disposal
Waste	Any material disposed of because it is no longer needed. It includes general wastes, hazardous wastes, difficult wastes, and other wastes as classified by the Waste Management Department.
Waste Generator	Any person or party who produces the waste material and/or the Occupier and/or Owner of the premises or facility where the waste is generated. The waste generator is also the “Owner of waste.”
Wastewater	All spent water is discharged from any activity of man or industrial process. For the purpose of this document, it is further classified into 2 types namely: a) domestic wastewater and b) trade wastewater.

WDS	Request for Permit of Waste Disposal (Hazardous/Trade Waste/Unwanted Materials) - An online permitting system for disposal of all types of waste/wastewater (except domestic waste) generated in the Emirate of Dubai.
Waste Collection	Collection within the meaning of this guideline is the loading, transport & any interim storage of waste for the purpose of transportation to a waste disposal and/or treatment plant.

1 INTRODUCTION

This guideline underscores adherence to the specified legal and regulatory framework, ensuring that activity 3830103- Battery Recycling is conducted in compliance with established laws, circulars, and guidelines. This serves to standardize practices across the industry, promoting sustainable waste management practices, safeguarding public health, and preserving the environment within the Emirate of Dubai.

The guideline encompasses operational procedures, safety protocols, contractual obligations, and permit requirements to ensure that waste management practices are conducted responsibly and sustainably within Dubai. Hence, this Technical Guide is intended to deliver:

a) General provisions such as mandatory training for all personnel involved in battery waste handling and disposal,
b) Battery waste disposal provisions and permitting requirements,
c) Procedures and requirements of Battery waste facilities and their operators.
d) Specific provisions for Battery Waste Recycling activity

Sample forms and permits are presented in the Annexes.

2 LEGAL FRAMEWORK, CIRCULARS, AND GUIDELINES

The relevant provisions of the following laws and regulations were used as guidance and references in the preparation of this technical guideline.

- Circular No. (1) of 2020 On the Comprehensive Inventory of the Recyclable Waste Data in the Emirate of Dubai
- Cabinet Decision No. (37) of 2001 on the Executive Regulations of Federal Law No. (24) of 1999 on Environmental Protection and Development - Hazardous Materials, Hazardous Waste and Medical Waste Regulations
- Federal Law (No.) 24 of 1999 and modified by Federal Law (No.) 11 for 2006 regarding Protection & Development of the Environment.
- Executive Order of Federal Law No. 24 of 1999 for Regulation of Handling Hazardous Materials, Hazardous Wastes and Medical Wastes, issued by Cabinet Decree No. 37 of 2001
- Local Order No. 11 of 2003 on Public Health and Safety of the Society in the Emirate of Dubai
- Local Order (No.) 61 of 1991 on the Environment Protection Regulations in the Emirate of Dubai
- Local Order (No.) 7 of 2002 on Management of Waste Disposal Sites in the Emirate of Dubai; as amended by Local Order No. (5) of 2003
- Executive Council Resolution (No.) 58 of 2017 Concerning the Approval of Fees and Fines of Waste Disposal in the Emirate of Dubai
- Executive Council Resolution No. (14) of 2015 Amending the Schedule of Public Hygiene-related Violations and Penalties Attached to the Implementing Bylaw of Local Order No. (11) of 2003 Concerning Public Health and Community Safety in the Emirate of Dubai
- Procedures and guidelines for implementing and implementing Administrative Order No. 30/2003, in accordance with Local Order No. 11/2003
- UAE Occupational Health and Safety Management System (OHSMS) National Standard
- Technical Guideline No. 4. on Duty of Care
- Technical Guideline No. 5. on Waste Classification
- Technical Guidelines (97) for Personal Protective Equipment – Foot Protection HSE from the Health & Safety Department
- Technical Guidelines (98) for Personal Protective Equipment – Hand Protection HSE from the Health & Safety Department
- Technical Guidelines (99) on Safety Signs at Work from the Health & Safety Department
- Technical Guidelines (59) for Personal Protective Equipment – Eye and Face Protection HSE from the Health & Safety Department
- Technical Guidelines on Hazardous Waste Collection & Transport Activity

The related circulars and posted information bulletin of this guideline are posted on Dubai Municipality's website – www.dm.gov.ae link to the Waste Department.

The Duty of Care Program is a management tool that controls the waste generated in Dubai. The regulation requires that all transfers of waste are appropriately recorded in order to assist in tracking the quantity generated and movements of waste. Waste treatment & recycling facilities must, therefore, ensure that the required signatures accompany the transfer of waste both into and out of their site and that there is an adequate description (source, quantity, and type) of the waste which contains all the information necessary for safe handling, treatment, recovery, or disposal.

3 SCOPE AND COVERAGE

These Technical Guidelines apply to both waste generators and waste operators involved in activities concerning waste treatment and recycling facilities licensed by the Department of Economy & Tourism (DET) to conduct 3830103- Battery Recycling activity in the Emirate of Dubai, including Free Zone Authorities as applicable.

4 APPLICATIONS FOR WASTE DISPOSAL PERMITS

The procedure for securing an online permit for the treatment and recycling of waste materials must be conducted through the DM Waste Treatment Section (DM-WTS) by requesting a Permit of Waste Disposal through the waste disposal service (WDS) to send the waste materials to a DM-Accredited Recycler or a facility operated by DM as shown in Annex 1: Request for Permit of Wastes Disposal. The WDS can be accessed at the Dubai Municipality's website – hub.dm.gov.ae - upon login with a UAE Pass/ User Management ID and password.

The WDS system conveniently allows applicants to file disposal requests 24/7, view request status, and print the WDS upon approval, including online payment of disposal charges. The following steps summarize the process of applying for an online WDS:

1. **The Waste Generator logs in using Google Chrome at hub.dm.gov.ae as a business with UAE pass/DMUM ID and clicks on "Apply for Service" - "Request for Permit of Wastes Disposal (Hazardous/ Recyclable/ Unwanted Materials)" and chooses "New Permit"** with all the necessary

attachments for each type of waste as will be described in the next sections.

2. **File attachments should be in PDF format.** (Ex. BL.pdf, photos.pdf)
3. **Total amounts of waste to be declared in the disposal request shall be in metric tons with the estimated quantity for the wastes that have been accumulated**, including the estimated waste amount to be sent to the facility during the validity period of the permit (three months from the date of issuance).
4. **The applicant will be informed through e-mail and SMS** once the application is approved by the WDS system.
5. **The exact address of the facility where waste is generated and stored shall be specified in the waste location details** in the application.
6. The **"Permit of Disposal/Destruction" can be obtained by logging in to the WDS account and clicking "Download Permit".**
7. The payment (amount in AED) **can be paid by an approved transporter with a valid NAFITH (smart gate) and RASID (GPS) account in DM-designated or accredited sites & facilities.**
8. Alternatively, **the fee can be paid by the owner of the waste (waste generator/applicant) who wishes to obtain a "Destruction Certificate" as proof that the waste has been accepted and disposed of at any DM-controlled waste treatment site**. Similar to the permit process, the waste generator/applicant must **log in at hub.dm.gov.ae as a business with UAE pass/DMUM ID. Click "Apply for Service" - "Request for Permit of Wastes Disposal (Hazardous/Trade Wastes/Unwanted Materials", choose "Disposal Certificate" in the request Type, select WDS permit on the drop-down list, get details and pay the corresponding fee online**.

4.1 Recyclable Hazardous Wastes

For **Hazardous Wastes intended for recycling** at DM-accredited facilities & recyclers, the following is additionally required:

1. **Application Form for Permit/NOC for Waste Processing/Recycling (Acceptance Letter)** using the format provided by the chosen recycler and as shown in Annex 4. A list of DM-approved recyclers is available on the DM Website, link to the "Waste Department Information Bulletin".

2. A **copy of the WDS permit shall be submitted to the DM-accredited recycler** to set the schedule of transport and to obtain a collection receipt and Destruction Certificate from the recycler for recording[2].
3. After completion of the recycling/reprocessing of recyclable waste materials, **the waste generator/applicant must log in using Google Chrome at hub.dm.gov.ae as a business with your UAE pass/DMUM ID. Click "Apply for Service" - "Request for Permit of Wastes Disposal (Hazardous/Trade Wastes/Unwanted Materials", Choose "Disposal Certificate" in the request Type, select WDS permit on the drop-down list, get details, and upload the recycling certificate**.
4. The DM **Accredited Recyclers are required to submit a monthly Comprehensive Material Recovery Report (MRR)** of the recyclable waste materials being processed by their facility to the Waste Treatment Section (WTS) every second (2) day of every month as per Circular No. (1) of 2020 On the Comprehensive Inventory of the Recyclable Waste Data in the Emirate of Dubai.
5. For **hazardous waste recyclers**, the **specific waste acceptance criteria set by the facility operators must be complied with**.
6. **Disposal fees are set by the facility operator**.
7. Samples of permits for the disposal of hazardous wastes to DM-accredited recyclers can be found in Annex 5

5 OPERATORS OF HAZARDOUS WASTE RECYCLING AND TREATMENT FACILITIES PROVISIONS

The following provisions apply to companies with a valid license for the specific economic activity or any third party engaged through a formal contract and who have attained prior authorization requests on behalf of the contracting party from the WSPD. The decision to accept or reject applications of a similar nature is at the sole discretion of the WSPD.

All facilities must comply with the **Post Environmental Clearance (EC) Compliance Monitoring and Reporting** which involves both Regulatory Monitoring (i.e. primarily site inspection of the facility performed by the DM-Environmental Sustainability department) and as applicable, self-monitoring in the form of Emissions Inventory reporting or submission. Facilities with emission sources are required to submit source descriptions, activity data and pollutant concentrations via the interactive online platform (http://www.dubaiairenvironment.dm.gov.ae/), in accordance with the

[2] Note: The applicant must add the remark that they undertake that only the above declared wastes will be sent for recycling and that together with the recycler they will be jointly responsible for the safe handling, recycling, and final disposal of any waste by-product.

compliance conditions of the EC. A user account to access the **online platform should be requested by contacting DM- Environment Sustainability and Environmental Assessment Section (AESEAS) via Emission_Inventory@dm.gov.ae**.

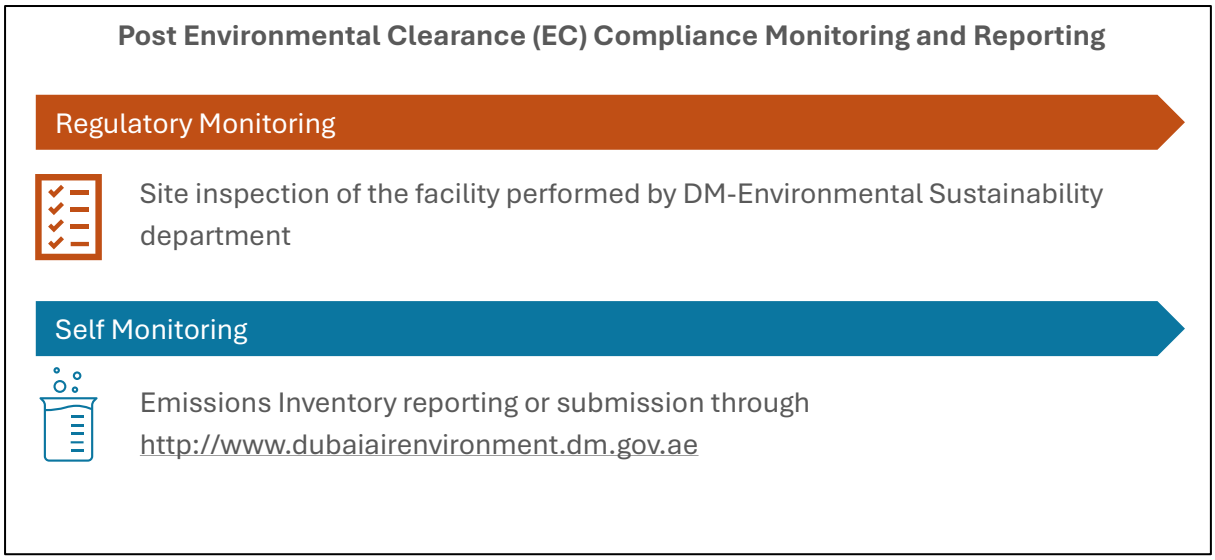

Figure 1 Post EC Compliance Monitoring and Reporting

Moreover, facilities must ensure that any appointed laboratory involved in the monitoring is accredited by EIAC[3], for the specific tests. In Addition, WSPD requires a 3rd party audit annually: waste audit, environmental audit and safety audit.

In alignment with the WDS procedures, and as mentioned previously in section 4, all DM Accredited Recyclers are required to submit a monthly comprehensive MRR of the recyclable waste materials being processed by their facility to the WTS every second (2) day of every month as per Circular No. (1) of 2020 On the Comprehensive Inventory of the Recyclable Waste Data in the Emirate of Dubai.

6 BATTERY WASTE RECYCLING

6.1 General Provisions

During the operation of a battery waste facility, it is imperative to ensure that the following key points are adhered to. Please also refer to the Technical Guidelines on Hazardous Waste collection.

6.1.1 Waste Receipt, Unloading, Processing, and Storage

Given the inherent hazards associated with battery waste, it becomes crucial for facilities managing Battery waste to comprehend and regulate the

[3] List of Accredited Laboratories: https://eiac.gov.ae/directory

characteristics of the Battery waste accepted for storage, treatment, or disposal. Insufficient identification and classification of incoming waste may lead to subpar treatment or disposal, as well as unintended reactions that could release hazardous substances or trigger fires and explosions. Consequently, required measures to govern waste acceptance and general actions to alleviate risks at Battery waste management facilities encompass:

- Establishing and maintaining a close relationship with the battery waste generator to understand the process generating the waste and to monitor any changes in the process or waste characteristics;
- Obtain a thorough understanding of the incoming battery waste. Such knowledge needs to take into account the battery waste characteristics and variability, the origin of the waste, the treatment and disposal under consideration, the nature of the waste residuals, if any, that may be generated during treatment, and potential risks associated with waste treatment and disposal;
- As mentioned previously in section 4.1, battery waste facility operators must set specific **Waste Acceptance Criteria** which must be shared beforehand with the waste generator. This acceptance criteria shall include, as applicable, tests of the incoming waste and documentation of the waste source (e.g., the processes producing the waste, including the variability of the process) and identifying the appropriate treatment/disposal.
- Maintain records of the total quantity of battery waste and each received and processed as well as disposal certificates of any process residuals produced. These records must be available for inspection.
- A list of all hazardous materials/chemicals used in the process should be maintained along with their expiry dates.
- Proper weighing scales must be available at the facility, and calibration certificates must be maintained for inspection.
- If bulk transport is used, maintain suitable weighbridge receipts for all inward and outward movements.
- A digital process flow diagram of the treatment process must be available
- A mass balance (in %) of all input and output streams must be available
- Generally, batteries are categorized into primary batteries (non-rechargeable) and secondary batteries (rechargeable). Annex 7 represents the EWC codes of the different types of batteries generated as waste in production, distribution, use and recycling.
- After collecting the batteries, they must be sorted according to their composition and size before they can be further recycled (since they are

rarely collected based on their composition). The most common sorting processes vary from manual sorting with adequate safety measures (visual and per hand) to automatic processes, which reach a purity of the sorted fractions up to 98%. Examples of automatic sorting processes are electromagnetic, radiographic and UV-based processes.

- Pretreatment of the batteries to be recycled. The preliminary stage involves the correct disassembly of the battery to recover the greatest number of battery components. It can be accomplished by mechanical (discharging, grinding and separating the battery elements) or thermal (distillation, pyrolysis, thermolysis or combustion) pretreatment. However, the thermal pretreatment overlaps with the recycling method. Furthermore, removing interfering and harmful substances such as cadmium and mercury from the recycling loop is also necessary.
- Implement an acceptance procedure that includes, as applicable, procedures that limit the acceptance of batteries to only that which can be effectively managed, including effective disposal or recovery of residuals from waste treatment. Only accept batteries if the necessary storage, treatment capacity, and disposition of any treatment residuals (e.g. acceptance criteria of the output by another treatment or disposal facility) are assured. The reception facility should include a laboratory to analyze incoming waste samples at the speed required by facility operations to determine if the waste is acceptable;
- In the case of treatment, analyze the waste output according to the relevant parameters important for the receiving facility (e.g. landfill or incinerator);
- Ensure that specific handling protocols are in place for the safe recycling of batteries, particularly those containing hazardous materials like lead or lithium.
- A clear process must be established for separating hazardous components and storing them securely to prevent environmental contamination.
- Sufficient personnel with the requisite qualifications should be available and on duty at all times. All personnel should undergo specific job training.
- All output waste streams and products, such as zinc, steel/iron, aluminum, nickel, copper, silver, manganese, cobalt, etc. must only go to licensed disposal facilities, respectively, off-takers.

6.1.2 Spills and Releases

Incidents like overfills, vehicle accidents, and failures in tanks and piping systems may result in releases during the storage and handling of waste. It is recommended to conduct the following measures:

- Use of dedicated fittings, pipes, and hoses specific to materials in tanks (e.g., all acids use one type of connection, all caustics use another), and maintaining procedures to prevent the addition of hazardous materials to incorrect tanks;
- Use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure safe transfer;
- Regular inspection, maintenance and repair of fittings, pipes and hoses;
- Provision of secondary containment, drip trays or other overflow and drip containment measures for hazardous materials containers at connection points or other possible overflow points;
- Overfills of vessels and tanks should be prevented as they are among the most common causes of spills resulting in soil and water contamination and among the easiest to prevent.
- Segregate hazardous wastes and materials from non-hazardous wastes and materials;
- Separate incompatible wastes, such as certain alkaline and acidic wastes that would release toxic gases if mixed; keep records of testing; store waste in separate drums or vessels based on their hazard classification;
- Lockout valves controlling material and waste transfer when not in use;
- Waste containers should be suitably labelled to include details of their contents and that their locations are recorded in a tracking system;
- Transfer or decant only one type of material at any one time;
- Conduct regular training and exercises for site staff regarding emergency procedures;
- Provide sufficient firewater containment to prevent uncontrolled discharge of water off-site in the event of a fire.

6.1.3 Fires and Explosions

Given the flammable and reactive nature of industrial hazardous wastes, it is essential to take specific precautions during their handling to avert accidents. In the case of battery waste facilities, incorrect handling can result in internal and external short circuits due to thermal effects or mechanical damage. A short

circuit can lead to fire or explosion and seriously affect people and the environment. Prevention and control strategies include:

- Appropriate storage of batteries is crucial to avoid fire incidents. This concerns, in particular, defective batteries and lithium metal batteries, lithium-ion batteries, and lithium batteries (used and other batteries [undamaged or damaged] together). Industrial batteries and loose cells, lead-acid and Ni-Cd accumulators (used, closed system with intact casing), and used accumulators (starter batteries with intact casings) may also be subject to strict storage regulations.
- Batteries should be packed in appropriate packaging with labelling (UN number, GHS hazard pictograms, etc.) after separation. Generally, the packaged batteries should be stored appropriately in suitable interim storage, protected from sunlight, excessive humidity, and high temperatures and away from flammable components.
- Firefighting equipment appropriate to the type of waste received at the site should be available;
- Minimize the storage of flammable liquids on site (e.g. fuel, flammable wastes);
- Perform crushing and shredding operations under full encapsulation and under an inert or exhausted atmosphere for drums and containers containing flammable or highly volatile substances;
- Provide an emergency tipping area for waste loads identified to be on fire or otherwise deemed to be an immediate risk;
- Prepare and annually review a fire risk assessment.

6.1.4 Air Emissions

Air emissions might involve the discharge of particulate matter and VOCs from storage vessels and equipment used in waste processing[4]. Facilities engaged in hazardous waste incineration should aim to reduce leaks from equipment involved in the transfer of hazardous waste, such as pumps and piping, by instituting a leak detection and repair program.

6.1.5 Water Effluents

[4] Additional information on VOC emissions prevention programs is provided in 40 CFR Part 264, Subparts BB and CC (http://www.access.gpo.gov/nara/cfr/waisidx_99/40cfr264_99.html)

Wash water and run-off can arise from storage and processing activities in waste management areas. The section covers general measures for controlling run-off. Furthermore, the subsequent techniques are advised for the prevention, reduction, and management of water effluents:

- Collect and treat wash water and run-off from waste storage and handling areas as potentially hazardous unless analytical tests determine otherwise;
- Segregate run-off from areas storing incompatible wastes.

6.2 Biological and Physico-Chemical Treatment

Biological and Physico-chemical treatment processes aim to eliminate, segregate, concentrate, or confine waste materials, reducing potential environmental, health, and safety risks and promoting the environmentally responsible management of the wastes. Typically applied to aqueous solutions or sludge, these treatments may be effective only for specific waste types and can face challenges from constituents in other waste streams. Hence, the waste acceptance procedures discussed earlier are particularly crucial. Many processes in this sector involve advanced equipment technology, necessitating well-trained staff. Specifically, for battery waste falling under EWC 16 06 06* "Separately collected electrolytes from batteries and accumulators", the suitable disposal method is in a Chemical-Physical treatment plant.

Guidelines for preventing, minimizing, and controlling potential environmental impacts from chemical treatment include:

- Design and operate facilities in accordance with applicable national requirements and internationally accepted standards[5];
- Prepare a quality control plan, which includes a definition of personnel roles, responsibilities, and qualifications, inspection procedures, and documentation;
- Clearly define the objectives and the expected reaction chemistry for each treatment process;
- Assess each new set of reactions and proposed mixes of wastes and reagents in a laboratory-scale test prior to waste treatment;

[5] See, for example, Basel Convention Technical Guidelines on Hazardous Waste Physico-Chemical Treatment and Biological Treatment, Basel Convention Series/SBC No. 02/09; U.S. EPA regulations at 40 CFP Part 264.

- Specifically, design and operate the reactor vessel so that it is fit for its intended purpose; this includes special coatings, foundations, and sensors for optimal temperature and pressure operations;
- Monitor the reaction so that it is under control and proceeding towards the anticipated result.

6.2.1 Air Emissions

- Enclose treatment and reaction vessels so that they are vented to the air via an appropriate scrubbing or other air emission abatement system;
- Install gas detectors (e.g. suitable for detecting HCN, H_2S, and NO_X) and implement safety measures to prevent releases of potentially toxic gases;
- Link the air space above filtration and dewatering processes to the main air pollution abatement system of the plant if such a system is in place.

6.2.2 Water Effluents

Effluent from both biological and chemical processes comprises run-off and leachate, as discussed previously in section 6.1, along with pollution control residuals and waste residuals (e.g., separated aqueous fractions of wastes). Water effluent control measures are outlined above in section **Error! Reference source not found.**. To prevent, minimize, and manage water effluents from biological and chemical treatments, the following measures are additionally recommended:

- Add flocculation agents to the sludge and wastewater to be treated to accelerate the sedimentation process and to facilitate the further separation of solids or, where practical, use evaporation (which avoids the use of flocculation agents);
- Preventing the mixing of wastes or other streams that contain metals and complex agents.
- Store leachate in a lined earthen basin or aboveground storage tanks;

6.2.3 Waste Residuals

Solid waste residuals are commonly produced through biological and chemical treatments and necessitate proper disposal. Suggested measures for preventing, reducing, and managing solid wastes involve:

- Restrict the acceptance of wastes to be treated by solidification/immobilization to those not containing high levels of VOCs, odorous components, solid cyanides, oxidizing agents, chelating agents, high TOC wastes, and compressed gas cylinders;
- Minimize the solubility of metals and reduce the leaching of toxic soluble salts by a suitable combination of water washing, evaporation, re-crystallization, and acid extraction when immobilization is used to treat solid waste containing hazardous compounds prior to landfilling;
- Based on the waste residual's physical and chemical characteristics, solidify, vitrify, melt, or fuse wastes as required/necessary prior to landfill disposal;
- Test the leachability of inorganic compounds (e.g., by using the standardized European Committee for Standardization (CEN) or U.S. EPA Toxic Characteristic Leaching Procedure TCLP) for waste to be landfilled.

7 OCCUPATIONAL HEALTH AND SAFETY

The most significant occupational health and safety impacts typically associated with
workers at waste management facilities occurring during operations include:

7.1.1 Accidents and injuries

- Workers are especially susceptible to accidents involving trucks and other moving equipment. Recommended measures include the implementation of traffic management systems and the presence of traffic controllers;
- Accidents may involve slides from unstable disposal piles, cave-ins of disposal site surfaces, fires, explosions, being caught in processing equipment, and being run over by mobile equipment;
- Other potential injuries include those resulting from heavy lifting, contact with sharps, chemical burns, exposure to potentially contaminated substances (i.e. fuel and foul sewage);
- Risk assessments of hazards should be conducted with common risks at battery recycling facilities, including manual handling; slips, trips, and falls; being hit by moving, flying, or falling objects; contact with moving machinery; and needles/sharps. Each risk assessment should identify the hazards, decide who might be harmed and how, evaluate the risks, decide on precautions and control measures (i.e. suitable training, regular

housekeeping, and PPE), and implement the findings. The risk assessment should be reviewed and updated as necessary.

7.1.2 Chemical exposure

- Smoke, dust, and bioaerosols can lead to injuries affecting the eyes, ears, and respiratory systems;
- Provide workers with appropriate protective clothing, gloves, respiratory face masks, slip-resistant shoes for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. For workers near loud equipment, noise protection should be included. For workers near heavy mobile equipment, buckets, cranes, and at the discharge location for collection trucks, include provision of hard hats;
- Provide adequate personnel facilities, including washing areas and areas to change clothes before and after work, as well as praying rooms;
- Ventilate enclosed processing areas (e.g., dust in waste size reduction areas, VOCs driven off by high temperatures during composting);
- Monitor breathing zone air quality in work areas at processing, transfer, and disposal facilities. Direct-reading instruments that measure methane and oxygen deficiency are of primary importance; these include combustible gas indicators, flame ionization detectors, and oxygen meters;
- The site should be a designated ‘no eating /drinking & smoking area.

To mitigate those risks, it is also necessary to develop a Hazard Management Plan (HMP) in line with the UAE Occupational Health and Safety Management System (OHSMS) (where applicable) to minimize the risk of injury from such hazards. Moreover, contingency plans in the event of equipment failure & Emergency procedures plan need to be considered. Fire safety requirements are also crucial, such as installing a ceiling sprinkler system alarm and fire hoses, which should be in place on-site. This equipment should be clearly marked and tested at appropriate intervals to confirm integrity. Site personnel should be made aware of their location, trained in their correct use, and know when it is safe to use them. Further Environmental impacts and mitigation measures are discussed in Annex 6.

8 REFERENCES

European Waste Framework Directive 2008/98/EC

European Committee for Standardization (CEN) or U.S. EPA leaching procedures)

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ANNEX 1: REQUEST FOR PERMIT OF WASTES DISPOSAL

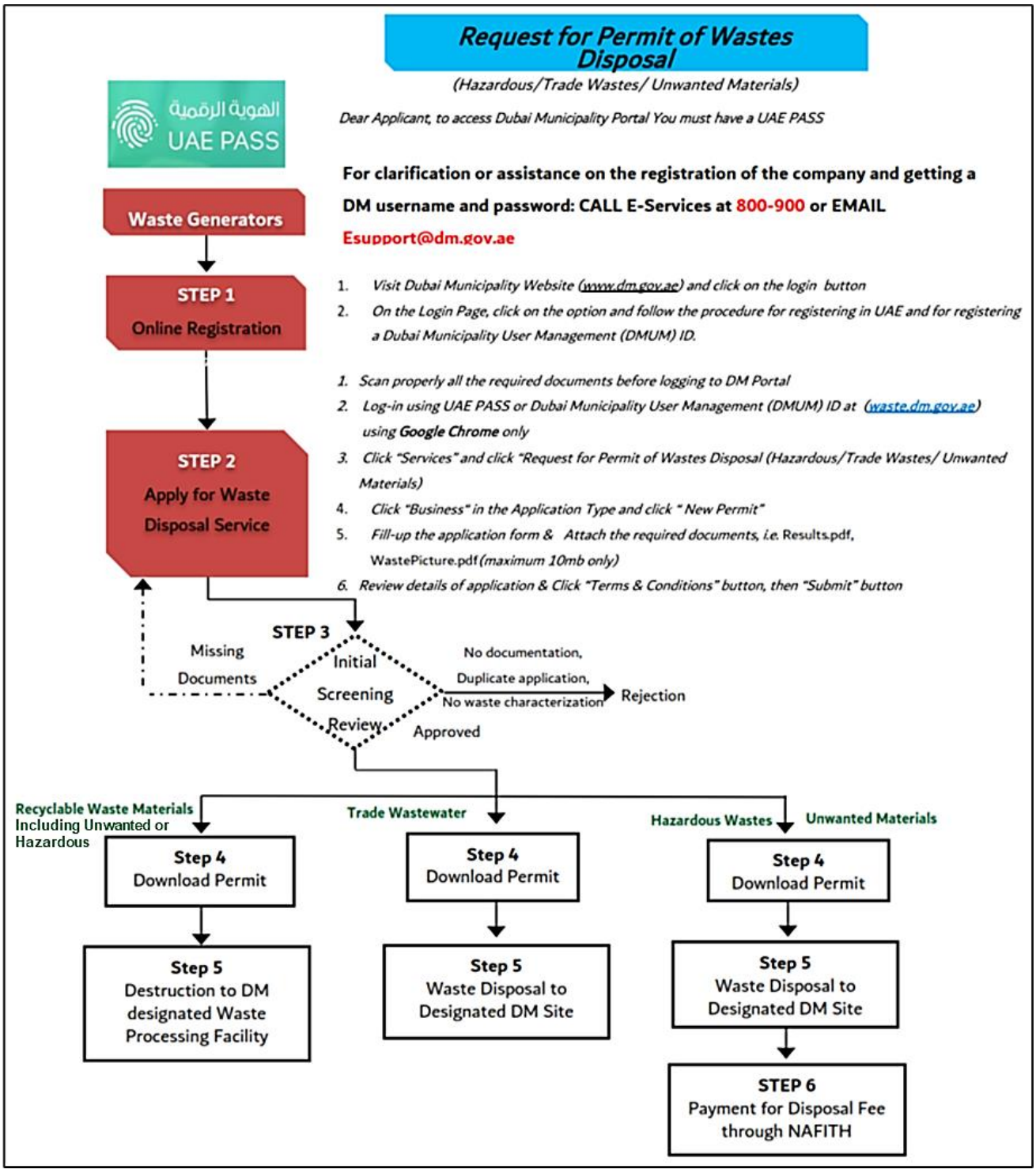

Figure 2: Online registration & request for permit of waste disposal procedures.

ANNEX 2: HAZARDOUS WASTES CLASSIFICATION IN THE EMIRATE OF DUBAI[6]

Table 1 Classification of Hazardous Wastes in the Emirate of Dubai

Class Code	Waste Type	Sub-class Code	Sub-class Waste
W18	**E-Wastes and other special wastes**	18.1	(Waste electrical and electronic equipment (WEEE) electronic gadgets, computers, and other electronic gadgets
		18.2	(Spent batteries) Spent lead-acid batteries, whole or crushed
		18.3	(Spent batteries) Alkaline and other types such as Li-ion/NiMH
		18.4	Pressurized gas cylinders/aerosols
		18.5	Mercury containing wastes (thermometers, switches, fluorescent lighting, etc.)

[6] Note: it is suggested to change this classification to match the EWC or else have the same format and rationale as the non-hazardous wastes presented in TG5.

ANNEX 3: WASTEWATER DISCHARGE LIMITS

Table 2 Dubai wastewater discharge limits according to the Environmental Standards and Allowable Limits of Pollutants on Land, Water, and Air.

INDICATORS		*Maximum Allowable Limits for Discharge to		
		Sewerage System	Land as for Irrigation	
Physico-Chemical	***Units***		Drip	Spray
Biochemical Oxygen Demand	*mg/l*	1,000	20	10
Chemical Oxygen Demand	*mg/l*	3,000	100	50
Chlorides	*mg/l*		500	350
Chlorine – residual	*mg/l*	10	Not less than 0.5 mg/l after 30 min contact time	
Cyanides as CN	*mg/l*	1	0.05	0.05
Detergents	*mg/l*	30		
Fluorides	*mg/l*		1	1
Nitrogen, ammoniacal	*mg/l*	40	5	1
Nitrogen, organic (Kjeldhal)	*mg/l*		10	5
Nitrogen, total	*mg/l*		50	30
Oil & Grease – Emulsified	*mg/l*	150		
Oil & Grease – Free oil	*mg/l*	50	5	5
pH (range)	*units*	6 – 10	6.0 – 8.0	6.0 – 8.0
Pesticides, non-chlorinated	*mg/l*	5		
Phenols	*mg/l*	50	0.1	0.1
Phosphorous (P)	*mg/l*	30	20	20
Sulfates, total	*mg/l*	500	200	200
Sulfides as S	*mg/l*	10	0.05	0.05
Surfactants	*mg/l*			
Suspended Solids (SS)	*mg/l*	500	50	10
Temperature	^{0}C	45 or > 5 of ambient		
Total Dissolved Solids (TDS)	*mg/l*	3,000	1,500	1,000
Metals				
Total Metals	*mg/l*	10		
Aluminum (Al)	*mg/l*		2	2
Arsenic (As)	*mg/l*	0.50	0.05	0.05
Barium (Ba)	*mg/l*		1	1
Beryllium (Be)	*mg/l*		0.1	0.1
Boron (B)	*mg/l*	2.0	2.0	2.0
Cadmium (Cd)	*mg/l*	0.3	0.01	0.01
Chromium (Cr)	*mg/l*	1.0	0.1	0.1
Cobalt	*mg/l*		0.1	0.1
Copper (Cu)	*mg/l*	1.0	0.2	0.2
Iron (Fe)	*mg/l*		2.0	2.0
Lead (Pb)	*mg/l*	1.0	0.5	0.5
Magnesium (mg)	*mg/l*		100	100
Manganese (Mn)	*mg/l*	1.0	0.2	0.2
Mercury (Hg)	*mg/l*	0.01	0.001	0.001
Molybdenum (Mo)	*mg/l*		0.01	0.01
Nickel (Ni)	*mg/l*	1.0	0.2	0.2
Selenium (Se)	*mg/l*		0.02	0.02
Silver (Ag)	*mg/l*	1.0		
Sodium (Na)	*mg/l*		500	200
Zinc (Zn)	*mg/l*	2.0	0.5	0.2
Bacteriological				
Fecal Coliforms	MPN/100 ml.	500	20	

ANNEX 4: APPLICATION FORM FOR WASTE PROCESSING/RECYCLING

Table 3 Application Form for Permit/NOC for Waste Processing/Recycling

APPLICATION FORM FOR PERMIT/NOC FOR WASTE PROCESSING/RECYCLING

COMPANY DETAILS

Waste Generator	(Company name)		
License No.		P.O. Box	
Contact Person		Designation	
Contact Info	Telephone & Mobile	Email	

WASTE DETAILS

Waste Description	
Source/Process	
Waste Location (Address of Company)	
Packaging Details/ Number of Packages	
Total Weight (tons)	

**The company and wastes details shall be the same in the online Waste Disposal Service request*

RECYCLER DETAILS

Company Name		License No.	
Address of Recycling Facility			
Contact Info	Telephone & Mobile	Email	
Recycler Reference No.			

ACKNOWLEDGEMENT OF RESPONSIBILITY

We hereby acknowledge that any misdeclaration, and/or breach of conditions hereof or of applicable environment protection regulations will warrant sanctions or fine as deemed appropriate.

For RECYCLING Company:	**For Waste Generator (Company Name)**
I acknowledge that the declared material applied and on the photos attached for recycling in our facility will not cause any form of pollution either on ground, water or environment during the processing of the wastes. I acknowledge that it is our responsibility to ensure that the material received will be fully destructed and unusable from its original form and will not be distributed in the market. A monthly material recovery report (MRR) will be submitted to Waste Treatment Section (WTS) for processing of waste. (name) (designation) (company stamp & signature & date)	I acknowledge that the wastes stated above was generated by us and is factually described by this application. I hereby certify that the named materials are properly classified, described, packaged, marked and labelled and are in proper condition for transportation. I hereby guarantee that the waste will be delivered to the Dubai Municipality Approved Recycler without loss or alteration. (company stamp & signature & date)

ANNEX 5: SAMPLE HAZARDOUS WASTE DISPOSAL PERMIT

Table 4 Sample Permit for Disposal of Hazardous Waste to DM Accredited Recycler

Waste Operations Department Waste Treatment Section				إدارة عمليات النفايات قسم معالجة النفايات
تصريح التخلص من النفايات الخطرة Permit for Disposal of Hazardous Waste				
Ref No WDS-240424-44325				Date 28/04/2024
Application Details				**بيانات التصريح**
Company Name	:	.....	:	اسم الشركة
License No.	:	614307	:	رقم الرخصة
Mobile No.	:	(+971)	:	رقم الهاتف المحمول
Email	:	..... @gmail.com	:	البريد إلكتروني
Waste Details				**تفاصيل النفايات**
Waste Description	:	Used Lead Acid batteries	:	وصف النفايات
Source/Process	:	Replaced CBS Batteries	:	المصدر / العملية
Waste Location	:	231 - AL NAHDA FIRST	:	موقع النفايات
Package Type	:	Palette	:	نوع الحزمة
Qty per package	:	56	:	
Liquid Wastes(volume)	:		:	النفايات السائلة (الحجم)
Total Weight (Metric Tons)	:	0.83	:	الوزن الإجمالي (طن متري)
Holding Tank Capacity (cubic meter)	:		:	سعة الخزان (مكعب)
Applicant Remarks	:	We undertake that only the above declared wastes will be sent for recycling. We and the recycler will be jointly responsible for the safe handling, recycling and final disposal of any waste by-product	:	ملاحظات مقدم الطلب
Approval Details				**تفاصيل الموافقة**
Classification	:	18.2 (Spent batteries) Spent lead-acid batteries, whole or crushed	:	التصنيف
Disposal Location	:	Dubatt Battery Recycling (Dubai Industrial City):	:	موقع التخلص
Disposal Method	:		:	طريقة التخلص
Remarks	:	This serves as PERMIT for collection and transport of declared wastes above and on the Application Form for Waste Processing/Recycling from waste generator site to facility of the collector/recycler (1) Waste generator shall ensure that the waste is in proper condition for transport of hazardous waste and shall not cause any form of pollution either on ground, water or air environment. (2) Only vehicles with valid "DM	:	ملاحظات
This document is electronically approved without a signature. To verify the authenticity of this document please visit https://waste.dm.gov.ae/Admin/DocumentVerification/VerifyDocument and enter the Document ID : WDS-240424-44325 and Verification Code : 757756 , or alternatively scan the QR Code				هذه الوثيقة معتمدة الكترونيا بدون توقيع، و للتحقق من صحتها يمكن زيارة الرابط أدناه https://waste.dm.gov.ae/Admin/DocumentVerification/VerifyDocument بادخال رقم الطلب WDS-240424-44325 و رمز التأكيد 757756 او مسح QR Code المجاور

ANNEX 6: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Table 5 Environmental Factors and Mitigation Measures

Particulate Matter (PM)	Odour
• Paving roads on site. • A bowser is used to spray water onto haul roads and waste storage and processing areas during dry and dusty conditions. • Utilize wheel-washes on incoming and outgoing vehicles. • Align building openings to minimize exposure to prevailing winds. • Install plastic curtains or roller shutter doors over building openings. • Keep station doors closed during operating hours, except when trucks are entering or exiting. • Install misting systems over tipping areas to “knock down” dust particles. • Implement speed limit restrictions on site haul roads. • Cover loads of waste that have the potential to emit significant dust during transport. • Undertake dust monitoring at specified locations on and off-site, if applicable. • Provide all site staff with PPE, including high-visibility clothing, FFP3 masks, and safety glasses.	• Enclose or cover loads of waste. • Refuse to accept certain highly odorous wastes. • Remove any other odorous waste from the premises as soon as practicable. • Increase the distance between the odor source and the receptor. • Practice “first-in, first-out” waste handling practices. • Regularly inspect and monitor waste handling areas. • Frequently clean/wash down waste handling areas. • Install ventilation systems with air filters or scrubbers. • Plant vegetative barriers, such as trees, to absorb and disperse odors. • Install plastic curtains or roller shutter doors on entrances and exits to contain odors when doors are opened to allow vehicles to enter or exit.
Water and Soil Pollution	**Noise and Vibration**
• Locate plants outside local flood zones, if applicable. • Cover the waste - use rain-tight and leak-tight HGVs and containers. • Keep surface water free of run-off contamination from waste, mud, and fuel/oil. • Implement impervious surfaces (i.e. paved surfaces) and engineered drainage systems. Ensure that there are sealed systems in place for potentially contaminated leachate from stored waste so that it is collected separately from surface water. • Use secondary containment around temporary storage areas, i.e. fuel. • Collect soil samples on-site and within immediate locations to establish baseline conditions. • Monitor the composition of the surface water (e.g. sampling at agreed locations, upstream/downstream of the site, on a monthly/ quarterly basis). • Monitor the flow and composition of foul water/sewer discharge. • Undertake site walkover (including nearby surface water courses) at agreed intervals. • Provide all site staff with PPE, including steel-tipped boots and gloves.	• Select quiet working equipment. • Shut down equipment when not in use. • Set a site speed limit of 15km per hour (or appropriate to site conditions and surroundings). • Enclose all waste-handling operations. • Concrete walls and structures should be used, which absorb sound better than metal structures. • Install shielding or barriers, such as trees, berms, or walls, around the facility to block and absorb noise. • Insulate building walls with sound-absorbing materials. • Locate administrative buildings between sources of noise and the community. • Locate sorting plant building openings (i.e. doors) away from receptors. • Keep doors closed during operating hours, except when vehicles are entering or exiting. • Establish operating hours that avoid early morning or late-night operations. • Set facility noise level limits and adhere to them.

	• Record incidents of noise or vibration that exceed these limits – these should be diarized so that potential causes can be identified, and procedures put in place to eliminate them. • Provide all site staff with PPE, including noise-dampening earplugs/muffs.
Litter	**Traffic**
• Covering all incoming and outgoing loads. • Implementing daily litter inspections and pick-ups at the facility and on surrounding streets. • A perimeter fence must be installed to prevent windblown litter from leaving the site.	• Create a robust and formal transport management plan. • Design internal and external roads to include highly visible markings, barriers, and signs (i.e. speed restrictions, traffic flow and separation areas between vehicles and pedestrian movements). • Drivers should be appropriately trained and licensed. • Create acceleration, deceleration, or turning lanes at site entrances and exits (where applicable) to maintain steady traffic flows around the facility. • Work with the community to designate inbound and outbound Heavy Goods Vehicles (HGV) traffic routes and ensure that drivers follow these routes. • Avoid traffic flows adjacent to noise-sensitive property. • Restrict incoming HGV queueing on public streets, i.e., if inadequate space is available on site to accommodate waiting HGVs, use a remote site as a waiting area for HGVs. • Where possible, schedule incoming traffic so that it does not coincide with local rush hours. • Regularly maintain and service vehicles to ensure they are running as efficiently as possible. • Switch off vehicles when not in use (both on-site and visiting vehicles). • Provide all site staff with PPE, including high-visibility clothing and steel-tipped boots.
Flies, Vermin and Birds	**Exposure to Potentially Hazardous Equipment and Substances**

• Hiring a professional licensed pest control company with expertise and experience in controlling specific vermin populations. • Seal or screen openings that allow rodents and insects to enter the building, such as door and window frames, vents, and masonry cracks. • Implement practices that reduce the likeliness of attracting vermin. • Provide and require the use of suitable personal protective clothing and equipment. • Maintain good housekeeping in waste processing and storage areas. • Grade the area properly to prevent ponding (to minimize insect breeding areas); • Use integrated pest-control approaches to control vermin levels, treating infested areas, such as exposed faces and flanks with insecticide, if necessary	• Supplying site staff with all necessary PPE. • Displaying brightly colored warning signs around equipment and machinery. • Regularly maintain and monitor equipment and machinery. • Implemented emergency shutdown mechanisms on equipment and machinery. • Keep all areas clean and tidy. • Check bunds and tanks for leaks. • Check the provision of oil spillage kits and absorbent materials. • Ensure tanks and containers are secured against unauthorized access. • Provide continuous staff training. • Make emergency phone numbers visible and accessible. • Provide worker immunization and health monitoring (e.g. for Hepatitis B and tetanus); • Clean and wash with disinfectant the cabins of heavy mobile equipment used at regular intervals;

ANNEX 7: LIST OF EUROPEAN WASTE CATALOGUE (EWC) OF WASTE BATTERIES

Table 6 Waste Batteries and their respective EWC codes

EWC Code	Description
16 06 01*	Lead batteries
16 06 02*	Ni-Cd batteries
16 06 03*	Mercury-containing batteries
16 06 04	Alkaline batteries except 16 06 03, mercury-containing batteries
16 06 05	Other batteries and accumulators
16 06 06*	Separately collected electrolyte from batteries and accumulators
20 01 33*	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33 (e.g. Lithium batteries)

(*): Hazardous waste

Note: In addition, batteries could be found in disposable cameras covered by Chapter 09 01 (09 01 11* and 09 01 12) and may also be included in wastes marked with EWC 16 02 13* or 16 02 15* or 20 01 35* (used equipment containing hazardous components).