

WASTE

REUSE, RECYCLING, RESOURCE RECOVERY, TREATMENT AND DISPOSAL POLICY

EAD-EQ-PR-P-05

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I. POLICY AIM

I.1 Background

Over the last decades, Abu Dhabi Emirate's waste management system and its supporting infrastructure has grown opportunistically, rather than systematically based on integrated planning. While the Emirate's waste management system has proved effective at collecting waste from where it has been generated and removing it out-of-sight, there are significant gaps in the processes and making best utilization in terms of reuse, recycle and resource recovery.

The Environmental Agency - Abu Dhabi (EAD), Tadweer (Center of Waste Management – Abu Dhabi (CWM)) and the concerned authorities have jointly developed a Waste Management Strategy for the Emirate of Abu Dhabi (2014) that specifies CWM will develop an integrated waste management system in Abu Dhabi that is based on the principles depicted by the waste management hierarchy and life cycle approach (LCA). LCA and the waste hierarchy consider integrated waste management system is environmentally effective and economically affordable. This approach will take into account a combination of reduction in the amount of waste generated, reuse or recycling of the waste, including resource recovery, treating the waste using best available technology and disposal in a sanitary landfill, only when waste cannot be otherwise managed.

This policy is part of a series of policy documents that have been prepared to establish the regulatory framework for integrated waste management in the Emirate of Abu Dhabi to achieve the overall objectives of the Abu Dhabi Environmental Vision 2030 and Abu Dhabi Environment Policy Agenda (ADEPA).

I.2 Objectives

This policy supports the application of the approach for optimizing waste reuse, recycling and resource recovery, including promoting market for recycled products, sustainable consumption and the overall objective of diverting waste away from landfills. Planning and decision-making will be consistent with life cycle approach whereby the relative resource requirements of managing waste are compared to recovery of energy, materials and by-products.

CWM will support the development of policies and markets for recovered products (e.g. recyclables, energy) that are consistent with the overall strategy and plan for waste management. This policy aims to support the Emirate's vision for an environmentally, socially and economically sustainable waste management system.

2. POLICY FRAMEWORK

2.1 Scope and Applicability

This policy is addressing the reduction, reuse, recycling, resource recovery, treatment and disposal of waste.

The policy is for the majority of waste in the Emirate of Abu Dhabi including non-hazardous solid waste, non-hazardous liquid waste (excluding sewage waste and drainage water), hazardous solid and liquid waste as well as medical waste. This policy does not include any aspect of nuclear (radioactive) waste.

The policy applies to all wastes generated by government and private sector entities (including commercial and industrial that include but not limited to healthcare facilities, schools, shopping malls, hotels, restaurants, labor camps, etc. as well as agriculture farms, animal farms and livestock), in the form of liquids and solids, whether they are potentially hazardous or non-hazardous.

The policy does not apply to wastes discharged to atmosphere in the form of gases, vapors, fumes, aerosols, dusts and particulates. However, dust and particulates collected from air pollution control devices are included in this policy.

This policy prohibits the open burning of any wastes unless specifically permitted by EAD (environmental permit) and CWM (waste management permit) and also prohibits unauthorized dumping of waste in desert, open area, highway verges, etc.

2.2 Policy Statement

Integrated waste management approach shall be based on benchmarking with best international practices considering the life cycle approach and waste hierarchy.

The concept of life cycle approach into waste management gives a broader view of all environmental aspects and ensures that any

selected option has an overall environmental benefits compared to other options. It also means that actions dealing with waste should be compatible with other environmental initiatives.

In order to decouple the production of products from the production of waste, it is necessary to invest more heavily in innovation. If appropriate investment is made, waste could become an asset – for example as a source of recycling material or as a source of energy. It is essential that solutions consider proper life cycle analysis of products and post usage processes in order to ensure waste is managed in a sustainable way to benefit the environment, society and the economy. Manufacturing and construction processes should be designed to minimize waste production and to optimize resource efficiency. Market incentives should be used to drive this optimization and to create effective markets for recycled materials.

In the waste hierarchy prevention or minimization is given the first priority, then reuse, recycling, other recovery operations and finally safe disposal. This hierarchy only makes sense if derogations are possible - not as a way of evading legislation, but as a way of showing that sustainable benefits may not always adhere to the hierarchy. A pragmatic approach of considering the best sustainable option should be practiced optimizing the benefits and ensuring the appropriate balance between the environment, the society and the economy.

The policy emphasizes reduction, reuse, recycling and resource recovery which all benefit from effective segregation at source (EAD-EQ-PR-P-04: Waste Collection, Segregation, Transfer and Tracking Policy). Considering LCA and the hierarchy approach, waste shall be managed in line with the waste classification policy (EAD-EQ-PR-P-01: Waste Classification Policy). The waste management shall be based on proper balance between economic and environment considerations.

Management options

Following practices shall be forbidden:

- All liquid waste being disposed in landfill;
- Putrescible solid waste (non-recyclable) being disposed in landfill;
- Recyclable solid waste being disposed in landfill;
- Used oil (engine and edible oil) being discharged in sewage network;
- Tires being disposed in landfill;
- Sewage sludge and waste from septic tank being disposed in landfill / land;
- Asbestos being mixed with construction and demolition waste;
- Refrigerants and ozone depleting substances being released to atmosphere;
- Hazardous and medical waste being mixed with household or municipal solid waste;
- Medical waste being disposed in landfill;
- Untreated hazardous waste being disposed in landfill; and
- Electrical and electronic waste and end of life vehicles being disposed into landfill without treatment / resource recovery.

The following table shows the management options of all waste type taking into consideration that the waste types based on the waste classification policy (EAD-EQ-PR-P-01: Waste Classification Policy).

Table 1. Management Options of all Waste Type

No.	Waste Classification	Examples of Waste	Management Options
1.	Non-hazardous Solid Waste.		
	A. Putrescible solid waste	<ul style="list-style-type: none"> • Household waste that contains putrescible organics • Waste from litter bins that contains putrescible organics • Disposable nappies, incontinence pads or sanitary napkins • Animal waste from slaughterhouse except for infected animals and animal waste from infected animals, which shall be considered as veterinary- hazardous waste 	Recovery of resource including biogas, biodiesel, biofertilizer or compost, animal fodder, etc. using best available technology including biological or thermal conversion
	B. Non-recyclable and non-putrescible solid waste	<ul style="list-style-type: none"> • Household waste from municipal clean-up that does not contain food waste and recyclables. • Waste collected by or on behalf of Tadweer (Center of Waste Management – Abu Dhabi) from street sweepings that do not contain food waste and recyclables. • Grit and screenings from potable water and water reticulation plants that have been dewatered so that they do not contain free liquids. • Fully cured and set thermosetting polymers and fiber-reinforcing resins 	Shall be incinerated to produce energy including district cooling or waste heat if feasible or shall be subjected to appropriate resource recovery

No.	Waste Classification	Examples of Waste	Management Options
	C. Recyclable and non-putrescible solid waste	<ul style="list-style-type: none"> • Glass, plasterboard, ceramics, bricks, concrete • Metal • Paper or cardboard • Plastic, rubber • Textiles • Wood waste • Used / broken furniture (e.g. bulky waste) • Construction and demolition waste • Waste tyres • End of life vehicles (ELV) and machinery after removing the hazardous waste components • Waste electronic and electrical equipment (WEEE) after removing the hazardous waste components • Virgin excavated natural material except for naturally occurring radioactive materials (NORM) • Asphalt waste including asphalt resulting from road construction and waterproofing works • Cured concrete waste from a batch plant • Foam • Styrofoam • Perlite 	Shall be recycled to produce recycled products
2.	Non-hazardous liquid waste	Non-hazardous liquid waste generated from commercial and industrial facilities.	Shall be treated and reused for irrigation / dust suppression, floor / pavement / road cleaning, etc. or shall be tertiary treated for recycling.
3.	Hazardous waste (liquid and solid)	<p>Hazardous waste as defined in the Waste Classification Technical Guideline defining the concentration limits materials to be classified as hazardous waste or pre-classified as hazardous waste.</p> <ul style="list-style-type: none"> • Medical / clinical waste including but not limited to veterinary waste and dead animals which have died of an infectious disease. • Asbestos waste. • Any material containing asbestos. • Coal tar or coal tar pitch waste (being the tarry residue from the heating, processing or burning of coal or coke) comprising of more than 1% (by weight) of coal tar or coal tar pitch waste. • Lead paint waste. • Nickel - cadmium batteries. • Lead - acid batteries from vehicles. • Used / waste engine oil. • Used oil filters (mechanically crushed), rags and oil-absorbent materials that contain petroleum hydrocarbons. • Residues of waste oils and solvent paints, varnishes and paint strippers in containers. • Used pesticides containers / cans including pesticide residues or waste. • Residual or waste bleach and other cleaning agents. • Used florescent tubes and energy saving light bulbs. • Used aerosol cans. • Hazardous components of end of life vehicles. • Hazardous components of waste electronic and electrical equipment. 	<p>Hazardous waste to be treated and stabilized / inertized to prevent any toxic leachability and tested for toxicity characteristics leaching procedure (TCLP) before disposal into a hazardous waste landfill (CWM TG # 01: Requirement & Procedure for Disposal of Hazardous Waste).</p> <p>Medical / clinical waste to be incinerated to make free from infectious / pathogenic organisms.</p> <p>Animals infected by epidemic diseases shall be dealt as per biosecurity guideline.</p> <p>Asbestos waste to be properly packed & labeled, stabilized making it non friable (CWM TG # 08: Management of Asbestos and Asbestos Containing Material in the Emirate of Abu Dhabi and AD EHSMS CoP # 1.1: Management of Asbestos Containing Materials).</p> <p>Used batteries shall be recycled in permitted facilities or returned to manufacturer.</p> <p>Used engine oil shall be recycled to produce base oil, etc.</p> <p>End of life vehicles and waste electronics to be subjected to recovery of material / resources like metals, refrigerant gases, etc.</p>

Waste prevention and minimization:

The primary focus of waste management has to be on working on the processes, so that waste generation could either be prevented or reduced. Minimization is the actions to avoid / reduce or in other ways diminish the waste at source. For industries, waste reduction would involve change in industrial processes, so that they produce less manufacturing waste. For commercial establishments, waste reduction would involve innovative ideas related to packaging, etc. Specific responsibilities of reducing packaging waste will be addressed in producer responsibility policy.

The policy encourages providing incentives (as part of the tariff mechanism) for waste reduction to:

- Industries to change industrial processes so that they produce less manufacturing waste, as well as general waste, and
- Commercial establishments to reduce the use of plastic bags, disposable food containers and other packaging related to their activities.

Waste reduction would involve generating mass awareness / providing education to all residents and establishments on methods of waste reduction, such as:

- Becoming more paperless by encouraging electronic communication and archiving;
- Avoiding purchase of excessive food and perishable items; and
- Avoiding use of packaging and shopping bags that are not necessary.

The policy encourages development of guidelines and incentives for manufacturers and retailers to reduce packaging.

Waste reuse: Another important aspect of waste management is to reuse materials and products. If the reuse is done at the source of generation, it significantly reduces the cost and maximizes the environmental benefits, by reducing the cost and environmental impact of waste collection, transport, treatment and disposal. It involves reusing materials and products in a form that is close to their original form. Materials are not considered wastes unless they are discarded.

Reuse would include sorting, cleaning, repairing and refurbishing and remanufacturing products into new products. For example, beverage bottles are readily reusable after cleaning. Broken furniture can be repaired and resurfaced for reuse. Tires can be recapped for reuse. The electronics industry has responded to consumer requests for greener products with significant programs to refurbish printer cartridges, computers, mobile phones, and a wide range of appliances. Collection of refrigerant gases from used electronics and refilling into other similar electronics for maintenance purpose is reuse of refrigerant gases.

For reuse to be possible, materials and products need to be segregated in a clean and good condition. Reusable materials and products shall not be required to be handled by licensed Environmental Service Providers unless they are discarded or taken for treatment / recycling.

Recycling and Resource Recovery by processing waste materials into new types of materials or energy are equally important aspect of a sustainable waste management approach. Recycling is a process to change waste into new products to reduce the consumption of fresh raw materials, reduce energy required for treatment of waste as well as reduce the environmental impacts due to the conventional waste disposal. For example, conversion of organic green wastes or food wastes into compost, conversion of wet putrescible organics into biogas, production of recycled concrete aggregate from construction & demolition waste and conversion of tires into shredded tire input for rubber products. Unless a recyclable material is actually recycled into new saleable product, it is not considered recycled.

However, the quantity of waste subjected to energy recovery or composting the same quantity shall be considered as processed for resource recovery. For recycling and resource recovery to be successful, source segregation of wastes is extremely important. For example construction & demolition waste if contaminated with asbestos or wood cannot be recycled.

The policy encourages use of recycled products over new or virgin material. It also provides the regulatory framework to develop an Emirate wide database for reusable / recyclable / by-products, so that others who may be interest in use such materials can directly approach the generator as identified in the database.

Waste to Energy (WTE) or municipal waste combustors (MWCs) are facilities where waste is converted into a usable form of energy, usually via combustion. Note that WTE techniques fit

into the biological and thermal conversion. WTE typically denotes a mass-burn combustion facility that produces electricity. WTE in the broader sense can include biological conversion (namely anaerobic digestion to produce biogas) and other thermal technologies such as gasification.

Biological conversion is either composting or anaerobic digestion. There are many vendor variations (such as use of heat, forced aeration), but all the variations of these two biodegradation mechanisms are simply aerobic or anaerobic decomposition.

Thermal conversion is either combustion or gasification. Under gasification, there are variations, such as gasification to syngas and char; pyrolysis to oils, syngas and char; plasma arc extremely high temperature gasification to gas and slag. Under combustion, the variations offer different feeding and furnace designs (e.g., mass burn, rotary kiln, fluidized bed), as well as combustion of wastes in cement kilns, or burning of refuse-derived fuel pellets or fluff.

Physico-chemical treatment is range of cool processing techniques often used in combination to optimize hazardous wastes treatment with the aim to reduce the hazardous potential of wastes. Chemical processes use chemical reactions to transform hazardous wastes into less hazardous or non-hazardous substances. Similarly, physical processes enable different waste components to be separated or isolated, for re-use or appropriate treatment or disposal.

Stabilization refers to a process by which waste is converted to a more chemically stable form. Chemical reactions take place between

the additives and the waste to reduce the contaminants of concern to their least soluble, mobile, and / or toxic state. Stabilization does not necessarily produce a solid. Biological processes are not considered.

Stabilization and solidification are very similar processes and the terms are often used interchangeably. They are techniques that reduce the mobility and toxicity of dangerous substances. Terms such as immobilization, fixation and encapsulation are also used for these treatment options. Stabilization processes change the dangerousness of the constituents in the waste and thus transform hazardous waste into non-hazardous waste.

Stabilization is a process by which contaminants (e.g. heavy metals) are fully or partially bound by the addition of supporting media, binders, or other modifiers. Stabilization is accomplished by mixing the waste with a reagent (depending on the type of waste and reaction planned, this can be, for example, clay particles; humic organic substances, such as peat; activated carbon; oxidizers; precipitating reagents) to minimize the rate of contamination migration from the waste, thereby reducing the toxicity of the waste and improving the handling properties of the waste at the landfill. To achieve this, a process should include a physico-chemical interaction between the reagent and waste, rather than just a dilution.

These stabilization methods make use of both the precipitation of metals in new minerals as well as the binding of metals to minerals by sorption. The process includes some sort of solubilization of the heavy metals in the material and a subsequent precipitation in or sorption to new minerals. The physical mechanisms

used in stabilization are: macro-encapsulation, microencapsulation, absorption, adsorption, precipitation and detoxification. There is an extensive range of sorbents and binders available for such purposes. Some of the most commonly used are: cement, pozzolans, lime, soluble silicates, organically modified clays or lime, thermosetting organic polymers and thermoplastic materials. In many cases, chemical reagents, sorbents and binders are used simultaneously.

Autoclaving is a time-tested process of sterilization of medical waste using high temperature and high pressure steam. Effective sterilization results in the destruction of bacteria, viruses, spores, fungi and other pathogenic microorganisms. Typical operating conditions for a gravity flow autoclave are - a temperature of at least 121 °C at a pressure of 15 psi for a autoclaving residence period time of at least 60 minutes or at a temperature of at least 135 °C at a pressure of 31 psi for a autoclaving residence period time of at least 45 minutes or at a temperature of at least 149 °C at a pressure of 52 psi for a autoclaving residence period time of at least 30 minutes. The autoclave process is an appropriate technology for the treatment of microbiology laboratory waste, human blood and body fluid waste, waste sharps and non-anatomical waste. The treated residue is acceptable for handling and disposal in a landfill.

Sanitary landfill: Well engineered sanitary landfills perform a wide range of treatments of wastes. They compact and consolidate the wastes into isolated cells separated by soil layers. Inside these cells, the wastes are anaerobically digested by microbial populations present in the

wastes. Leachate and biogas are collected and treated and biogas may be utilized for energy recovery.

The least preferred option in waste management is disposal of wastes into sanitary landfill. Ideally, in an environment where robust market demand is available to enable the maximum level of recycling and resource recovery that is technically possible, landfill would accept only the residuals that cannot be treated or recycled. Also, hazardous waste after stabilization, encapsulation, chemical fixation, would need to be disposed of safely in the hazardous waste landfill. However, such waste shall be tested for toxicity characteristics leaching procedure (TCLP) prior to disposal.

The policy encourages minimization of wastes going directly to sanitary landfill, using the life cycle approach for sustainable consumption and by developing and stimulating local and regional market demand for recycled product.

2.3 Legal Authority

This policy requires that all waste management facilities (reuse, recycling, resource recovery, treatment and disposal) shall be licensed by CWM, obtain environmental permit from EAD and other relevant licenses / permits from respective government authorities as detailed in the licensing and permitting policy (EAD-EQ-PR-P-03: Licensing and Enforcement Policy for Waste Sector). Also, waste shall be handled / collected / transported / treated / disposed only by Environmental Service Provider licensed specifically for the purpose. Moreover, waste shall

not be transported out of the Emirate of Abu Dhabi without proper permit.

This policy is issued based on the regulatory structure as referred to in:

1. Federal Law No. 24 of 1999 regarding Protection and Development of the Environment;
2. Abu Dhabi Law No. 21 of 2005 regarding Waste Management in the Emirate of Abu Dhabi;
3. Abu Dhabi Law No. 17 of 2008 regarding establishing the Center of Waste Management - Abu Dhabi; and
4. Federal Cabinet Decree No. 37 of 2001 regarding the Regulations for the Handling of Hazardous Materials, Hazardous Wastes and Medical Wastes.

2.4 Effective Date

The policy will come into effect and shall be implemented for enforcement six months after the date of official approval.

3. POLICY ANALYSIS

3.1 Impact Assessment

The implementation of this policy will help for the achieving many outcomes and benefits such as:

- Achieving integrated waste and resource management planning, programs and service delivery on an emirate wide basis;
- Reducing the environmental and health risk resulting from the improper and illogical generation and management of wastes;
- Encouraging the efficient use of resources in accordance with the principles of sustainable development and life cycle approach;
- Encouraging sustainable use of recycled products;
- Promoting the health, safety and welfare of the people of the Emirate of Abu Dhabi, and protecting the environment by establishing requirements and guideless for the management of the waste;
- Positive contribution to the economic development as result of recycling, reusing of waste materials and use of recycled products; and

- Encouraging the government and private sectors to share responsibilities and creating a sense of social accountability,for managing waste.

On the other side, implementing this policy may add some cost of processing of waste, like the cost of proper disposal (sanitary landfill), which is obviously less than the cost of the environmental damage. Processing cost to produce recycled products may be more expensive than using the natural resources, but could be cheaper if the environmental cost is taken into considerations.

3.2 Measurement of Actions

Through Abu Dhabi Environment Vision 2030, EAD has been working with CWM and other stakeholders and has developed strategies with the aim of improving waste management system.The following outcomes have been set, which can be achieved by pragmatic implementation of a life cycle approach in waste management and this policy will significantly help in achieving the outcomes.

Table 2.Waste Management Measures

Priority	Outcome	Measure
Waste reduction, recycling and reuse	Moderated municipal solid waste generation.	Municipal solid waste generation in kg/capita/day.
	Moderated construction & demolition (C & D) waste per construction GDP.	C & D waste generation in kg/ construction GDP Unit.
	Waste streams effectively diverted from landfill to the most appropriate and environmentally sound treatment or disposal alternative.	% of municipal, commercial and industrial waste diverted.
	Limited agricultural waste that is disposed of in landfills.	% of agricultural waste sent to landfills .
	Increased capacity of electricity and heat generated from waste sources.	% of total non -recyclable used for energy recovery (Refuse derived fuel "RDF" or waste to energy or biofuel from municipal solid waste, etc.).
Sanitary handling and disposal of waste	Sanitary engineered landfill / disposal sites.	% of landfilled waste disposed of in sanitary engineered sites.
	Medical and hazardous waste properly treated before reuse or disposal.	% medical and hazardous waste appropriately treated .
	Domestic consumption that favors fewer material-intensive goods.	Material intensity in direct material input (DMI) per capita.
	Limited embodied GHG emissions in materials used for domestic consumption.	Energy intensity in tons of CO ₂ Eq / DMI.

4. REFERENCES

4.1 Citations Included

Federal Law No. 24 of 1999 regarding Protection and Development of the Environment.

Federal Law No. 28 of 2001 regarding establishing the Emirates Authority for Standardization and Metrology.

Abu Dhabi Law No. 21 of 2005, Waste Management in the Emirate of Abu Dhabi.

Abu Dhabi Law No. 17 of 2008 regarding establishing the Center of Waste Management - Abu Dhabi.

Federal Cabinet Decree No. 37 of 2001 regarding the Regulations for the Handling of Hazardous Materials, Hazardous wastes and Medical Wastes.

Board Degree No. 1 for the year 2010 on the imposition of fees on producers and transporters of waste of all types and license fees and permits at the Center of Waste Management - Abu Dhabi.

Abu Dhabi Decree No. 2 G24 of 2009 for the tariff system of the waste in the Emirate of Abu Dhabi.

EAD-EQ-PCE-SOP-03: Permitting of Industrial, Commercial, and Light Industrial Projects in Abu Dhabi.

CWM TG # 4: NOC Requirements for Construction of New Building, Infrastructure and Labor Camp.

CWM TG # 5: Permitting of Cleaning and Transportation of Oil and Grease from Tanks, Pipelines, etc.

CWM TG # 6: Requirements and Procedures for Registration of Waste Skips and Container

CWM TG # 7: Test Requirements for Treated Wastes including Disposal.

CWM TG # 9: Permitting & Licensing Waste Transportation Vehicles & GPS Requirements.

CWM TG # 10: Inspection of Waste Treatment Facilities, Waste Transportation and Pest Control Facilities.

CWM TG # 11: Permits and Licensing Requirements for Transportation, Treatment and Recycling Facility.

Health Authority - Abu Dhabi, Policy on Medical Waste Management in Health Care Facilities: PPR/HCP/P0002/07 of 2007.

Health Authority - Abu Dhabi, Standard of Waste Management in Health Care Facilities: HAAD/HSED/ST/0016/HS_EHSMS of 20011.

International Convention for the Prevention of Pollution of the Sea by Oil, 1954 and its amendments.

International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969.

International Convention on the Prevention of Marine Pollution from Ships, 1973, and as amended by the Protocol in 1978.

Vienna Convention for the Protection of the Ozone Layer of 1985 and Montreal Protocol on Substances that Deplete the Ozone Layer of 1987.

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal, 1989.

United Nations Framework Convention on Climate Change for the year 1992.

1992 Protocol Concerning Amendments on International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969 and International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971.

Montreal Amendments (London 1990, Copenhagen 1992, Montreal 1997, Beijing 1999), Kyoto Protocol, 1997.

Kuwait Regional Convention for cooperation on the protection of the marine environment from pollution, 1978.

Regional Convention of Protocol on the Control of Marine Transboundary Movements and Disposal of Hazardous Wastes and Other Wastes, 1998.

Waste Management Strategy for the Emirate of Abu Dhabi, 2014.

Abu Dhabi Environment Policy Agenda (ADEPA), 2014.

4.2 Definition of Key Terms

Please refer to the waste definition document for all key terminology.

4.3 Resources Needed to Support This Policy

For the proper implementation of this policy the Integrated Waste Management Master Plan should be prepared, implemented and updated.