

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998), NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 OF 2008) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT (ACT 39 OF 2004)

DRAFT NATIONAL NORMS AND STANDARDS FOR ORGANIC WASTE TREATMENT

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DEFINITIONS

1. DEFINITIONS

In these standards, any word or expression to which a meaning has been assigned in the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008 as amended) has the meaning so assigned, unless the context otherwise indicates.

“Aerobic treatment” means any treatment process requiring free oxygen.

“Anaerobic treatment” means any treatment process requiring an absence of free oxygen.

“Agro-processing” is a subset of manufacturing that processes raw materials and intermediate products derived from the agricultural sector. Agro-processing thus means beneficially transforming products that originate from agriculture, forestry and fisheries.

“Biodegradable” means any substance or object capable of being decomposed by bacteria or other living organisms and thereby avoiding pollution.

“Biogas” means a mixture of gases produced as a result of anaerobic breakdown of organic matter by micro-organisms. The gases in the mixture are methane, 60%, which is the main component and a source of fuel; carbon dioxide, 36%, and hydrogen, oxygen, nitrogen, hydrogen, siloxene and sulphide making up the rest.

“Category 1 feedstock” are organics that have the lowest environmental impact but have the potential to generate offensive odours. These include garden and landscaping organics, untreated timber (sawdust, shavings, timber offcuts, crates, pallets, wood packaging), natural fibrous organics (sugar bagasse, peat, straw, seed husks etc.) and processed fibrous organics (paper, cardboard, paper-processing sludge, non-synthetic textiles).

“Category 2 feedstock” are organics that have a greater environmental impact than Category 1 and have the potential to attract vermin and vectors. These include natural or processed vegetable organics (vegetables, fruit and seeds and processing sludges and wastes, winery, brewery and distillery wastes, food organics excluding those in Category 3) and biosolids and manures (sewage biosolids, animal manure and mixtures of manure and biodegradable animal bedding organics).

“Category 3 feedstock” are organics that may generate harmful leachate, which could contaminate surface water, groundwater and soil if not correctly managed. These include meat, fish and fatty foods (carcasses, parts of carcasses, blood, bone, fish, fatty processing or food), fatty and oily sludges and organics of animal and vegetable origin (dewatered grease trap, fatty and oily sludges of animal and vegetable origin) and mixed residual waste containing putrescible organics (putrescible organics including household domestic waste, commerce and industry waste sent to municipal sites).

“Compost” means a stabilised, homogenous, fully decomposed substance of animal or plant origin to which no plant nutrients have been added and that is free of substances or elements that could be harmful to man, animal, plant or the environment.

“Compostable organic materials” means a carbon-based material of animal or plant origin that naturally enhances fertility of soil through a natural degradation process but excludes human made organic chemicals. This excludes infectious, poisonous, health-care and hazardous organic wastes.

“Composting” means a controlled biological process in which organic materials are broken down by micro-organisms.

“Contaminated organic material” means organic feedstock that contains significant levels of toxic chemical compounds and metal compounds; physical contaminants such as plastic and glass or pathogenic contaminants that will affect the quality of the processed product. These materials must be separated from the general organic feedstock and treated separately.

“Digestate” means the material remaining after the anaerobic digestion of a biodegradable feedstock.

“Feedstock” means the raw material required to supply or fuel a machine or industrial process. For the purpose of this document, feedstock includes any organic materials included in a specific treatment that is biodegradable or fermentable. This includes waste or non-waste organic material.

“Fertiliser” means any substance which is intended or offered to be used for improving or maintaining the growth of plants or the productivity of the soil.

“Handling” means functions associated with the movement of waste, including storage, treatment and ultimate disposal, by means of manual systems or automated systems.

“Hazardous waste” means waste that has been classified as hazardous in the NEM:WA based on the nature of its physical, health and environmental hazardous properties (hazard classes) and the degree or severity of hazard posed (hazard categories).

“Landfill gas” means a combination of natural gases that form as a result of the anaerobic decomposition of organic waste in a landfill site.

“Leachate” means an aqueous solution arising when water percolates through decomposing waste and / or as a result of the biodegradation of the waste. It contains final and intermediate products of decomposition, various solutes and waste residues.

“Liner” means a layer of impermeable material placed beneath a landfill, lagoon or any waste storage site and designed to direct leachate to a collection drain or sump, or to contain leachate. It may comprise natural materials, synthetic materials, or a combination thereof.

“Monitoring” means continuous or non-continuous measurement of a concentration or other parameters for purpose of assessment or control of environmental quality or exposure and the interpretation of such measurements. The process of checking for changes in status or trends over a period of time. This may be achieved by compiling successive audits or analyses results.

“Offensive odour” means any smell which is considered to be malodorous or a nuisance to a reasonable person.

“Organic fertiliser” means a fertiliser manufactured from substances of animal or plant origin, or a mixture of such substances, and that is free of any substances that can be harmful to man, animal, plant or the environment containing at least 40g / kg prescribed nutrients.

“Organics” means both processed and unprocessed compostable organic waste.

“Organic material waste” means waste of biological origin which can be broken down, in a reasonable amount of time, into its base compounds by micro-organisms and other living things and/or by other forms of treatment.

“Pre-Treatment” means a form of treatment that takes place prior to the utilisation of the technologies identified that may be required to minimise the risk associated with pathogens, bacteria or prions that could be hazardous to the environment and human health. This can include sterilisation, pasteurisation, UV treatment or any similar process required for a specific period of time.

“Putrescible organic waste” means organic matter capable of being decomposed by microorganisms and of such a character and proportion as to cause obnoxious odours and to be capable of attracting or providing food for birds or animals. Often associated with the organic fraction of municipal solid waste.

“Riparian habitat” includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

“Recycling” means a process where waste is reclaimed for further use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.

“Recovery” means the controlled extraction or retrieval of any substance, material or object from waste.

“Renewable Energy” means energy obtained from a source that is not depleted when used and can be naturally regenerated over a short time scale such as wind, solar, geothermal and tidal energy, but will also include energy from the decomposition of organic material.

“Sterilise” means make something free from bacteria or other living micro-organisms.

“Thermal treatment” means incineration, co-processing and other high temperature treatment of general waste.

“Treatment” means any method, technique or process that is designed to change the physical, biological or chemical character or composition of a waste, or remove, separate, concentrate or recover a hazardous or toxic component of a waste; or destroy or reduce the toxicity of a waste.

“Watercourse” means –

- A river or spring;
 - A natural channel in which water flows regularly or intermittently;
 - A wetland, pan, lake or dam into which, or from which water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act 36 of 1998);
 - A watercourse includes, where relevant, its bed and banks.
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“Waste”¹ means

– any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to NEMWA; or

-any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette,

but any waste or portion of waste, referred to in sections (a) and (b), ceases to be a waste-

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;

(ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered;

(iii) where the Minister has, in terms of section 74 of NEMWA, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

“Waste Management Activity” means any activity listed in terms of NEM:WA and includes the importation and exportation of waste, the generation of waste, the accumulation and storage of waste, the collecting and handling of waste, the reduction, re-use, recycling and recovery of waste, the trading in waste the transportation of waste, the transfer of waste and the disposal of waste.

“Woody plants” mean plants that contain lignin that cross-links cellulose, hemicellulose, and pectin components to provide structural support. Plants are considered as having characteristics of wood or are woody when the lignin content is greater than 20%. This includes trees and shrubs as well as some herbaceous plants and bamboo.

ACRONYMS

APR –Aqueous Phase Reforming

BPEO – Best Practicable Environmental Option

DAFF – Department of Agriculture, Forestry and Fisheries

DEPARTMENT – Department of Environmental Affairs

DoE – Department of Energy

DWS – Department of Water & Sanitation

HTC – Hydrothermal Carbonisation

HTL – Hydrothermal Liquefaction

¹ Definition as per the National Environmental Management: Waste Act (NEM:WA, Act 59 of 2008 as at 2 September 2014)

NEMA – National Environmental Management Act 1998 (Act No. 107 of 1998, as amended)

NEM:AQA –National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004, as amended)

NEMWA- National Environmental Management: Waste Act 2008 (Act No. 59 of 2008, as amended)

SANS – South African National Standards

SAWIS – South African Waste Information System

SCWG – Supercritical water gasification

SDS – Safety Data Sheet

SEMAs – Specific Environmental Management Acts

SOP – Standard Operating Protocol

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2. PURPOSE

These norms and standards aim at controlling the processing of organic waste material at any facility that falls within the threshold as described in section 3 of these norms and standards in order to avoid, prevent or minimise potential negative impacts on the bio-physical and socio-economic environment.

3. APPLICATION

- 1) The sorting, shredding, grinding, crushing, screening or bailing of general waste at a facility that has an operational area in excess of 1000m² (NEM:WA GN 921).
- 2) These norms and standards apply to the recycling of organic waste at a facility that has an operational area in excess of 500m² (NEM:WA GN 921).
- 3) These norms and standards apply to the recovery of organic waste including the refining, utilisation or co-processing of organic waste in excess of 10 tons but less than 100 tons per day (NEM:WA GN 921).
- 4) These norms and standards apply to any organic waste treatment facility that has the capacity to process in excess of 10 tonnes but less than 100 tonnes of organic waste material per day (NEM:WA GN 921).
- 5) These norms and standards apply to the construction of any organic waste facility where the capacity of the facility is able to process in excess of 10 tonnes but less than 100 tonnes of organic material per day (NEM:WA GN 921).
- 6) These norms and standards apply to the construction and operation of any organic waste facility processing animal matter not intended for human consumption for installations handling in excess of 1 ton of raw material per day (NEM:AQA GN 893).
- 7) These norms and standards apply to the construction and operation of any organic waste facility using applied heat (thermal treatment) in the treatment general waste exceeding 10kg per day (NEM:AQA GN 893).
- 8) The norms and standards are applicable throughout the Republic of South Africa.

4. FEEDSTOCKS AND TECHNOLOGIES

See Annexure 1 for details of treatment technologies.

TYPES OF FEEDSTOCK AND TREATMENT OPTIONS					
Agriculture:	Mechanical	Chemical	Anaerobic	Aerobic	Thermal
Manure	✓		✓	✓	✓
Mortalities	✓	✓	✓	✓	✓
Biomass: Lignocellulose (woody)					
Agricultural crop residue	✓	✓		✓	✓

TYPES OF FEEDSTOCK AND TREATMENT OPTIONS					
Agriculture:	Mechanical	Chemical	Anaerobic	Aerobic	Thermal
Invasive plant species	✓	✓		✓	✓
Plantation residue	✓	✓		✓	✓
Sawmill residue	✓	✓		✓	✓
Biomass: Low Lignocellulose (non-woody)					
Agricultural crop residue	✓	✓	✓	✓	✓
Invasive plant species	✓	✓	✓	✓	✓
Sugar bagasse	✓	✓	✓	✓	✓
Processing:					
Abattoir Waste	✓	✓	✓	✓	✓
Food Oils	✓	✓	✓	✓	✓
Organic Fraction of Municipal Solid Waste (MSW)	✓	✓	✓	✓	✓
Restaurant Waste	✓	✓	✓	✓	✓
Food processing	✓	✓	✓	✓	✓
Sewage:					
Sludge	✓	✓	✓	✓	✓

- 1) An organic waste treatment facility may not include the following in a facility considered in terms of this Norms & Standards –
 - a) Any infectious animal waste or carcass classified as hazardous;
 - b) Raw sewage;
 - c) Sewage sludge that does not meet the minimum quality standards for sludge as determined by the Department of Water & Sanitation.

5. MINIMUM REQUIREMENTS FOR THE DESIGN AND PLANNING PHASE

- 1) An organic waste treatment facility considered in terms of these norms and standards may not be constructed or operated in an environmentally sensitive area such as –
 - a) Within natural watercourses and within 32m of a natural watercourse, measured from the edge of the watercourse as defined by its riparian habitat;

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- b) Within wetlands or floodplains, where the facility will be located inside of the 1 in 100 year floodline;
 - c) Within estuaries or within 100m inland of the high water mark of, the sea or an estuary;
 - d) On shifting sand dunes or geologically unstable formations;
 - e) Where the construction of the activity and associated infrastructure requires the removal of more than 300m² of Endangered or Critically Endangered vegetation.
- 2) An organic waste treatment facility must submit, prior to construction the following –
- a) A Standard Operating Protocol (SOP) as per Annexure 2.

6. MINIMUM REQUIREMENTS FOR THE CONSTRUCTION PHASE

- 1) Construction of an organic waste treatment facility may not commence without the following –
- a) Confirmation of registration with the Department for the establishment of an organic waste treatment facility in terms of these norms and standards;
 - b) Any other approvals required by law, including but not limited to the following:
 - i. Planning, zoning and building plan approvals from the local municipality as is required;
 - ii. Any approvals in terms of local municipal by-laws such as storage, registration of waste contractors, flammable substances storage and transport, permitting of scheduled trades, trade effluent discharge;
 - iii. Registration in terms of the National Gas Act (Act 48 of 2001) for any facility producing gas from an alternative gas source;
 - iv. Registration in terms of the Fertiliser, Farm Feeds, Agricultural Stock Remedies Act (Act 36 of 1947) for any facility producing organic fertiliser or protein for livestock use;
 - v. Compliance with the existing Norms & Standards for the Storage of Waste.

7. MINIMUM REQUIREMENTS FOR SECURITY AND ACCESS CONTROL

- 1) Any organic waste treatment facility complying to these terms of these Norms & Standards must include the following –
- a) Details of the waste generator from whom the organic material originates;
 - b) Details of the transport operator delivering the organic material;
 - c) Record of type, volume and source of all organic material accepted onto the waste management site;
 - d) If a weighbridge is installed for measuring quantity, it must be correctly installed and certified and must, where practicable, be operational at all times.
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- 2) The facility owner / management must put into place provisions for denying unauthorised access to the following areas
 - a) Areas used for receiving, storing and processing of organics, process residuals and contaminated materials;
 - b) All areas used to store flammable materials or chemicals.
 - 3) The facility owner / management must put into place provisions related to:
 - a) Problem animals, birds and / or vermin that may be attracted to the feedstock storage areas;
 - b) Wind blown litter;
 - c) Fire management.

8. GENERAL REQUIREMENTS

- 1) An organic waste treatment facility must comply with the following where applicable to the technology type –
 - a) General Requirements for Organic Waste Treatment Facilities as per Annexure 3.
- 2) Any organic waste treatment facility must be compliant with the provisions of the Occupational Health & Safety Act, 1993 (Act No. 85 of 1993);
- 3) Any organic waste treatment facility must be compliant with the provisions of the National Dust Control Regulations published in terms of section 53(o), read with section 32 of the NEM:AQA 2004, where applicable;
- 4) Any organic waste treatment facility must be compliant with the provisions of the National Greenhouse Gas Emission Reporting Regulations published in terms of section 53(aA), (o) and (p), read with section 12 of the NEM:AQA , 2004, where applicable;
- 5) The National Ambient Air Quality Standards published in terms of section 9(1) of the NEM:AQA 2004 may not be exceeded as a result of the treatment of organic waste at a facility contemplated in terms of these norms and standards;
- 6) Any organic fertiliser produced at an organic waste treatment facility must comply with the following requirements:
 - a) DAFF standards for organic fertilisers as contained in the Regulations Regarding Fertilisers dated 23 March 2007 in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947;
 - b) DWS guidelines for disposal of wastewater and sludge to land;
 - c) DWS Revision of General Authorisations dated September 2013 in terms of Section 39 of the NWA pertaining to the irrigation of wastewater limit values;

9. TRAINING AND CAPACITY BUILDING

- 1) An organic waste treatment facility must, during the safety, health and environmental induction, train any new employee or employees on waste management in order to identify, prevent, minimise or manage actions or behaviour that is likely to cause
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adverse impacts on the environment as a result of construction, operation and decommissioning of the facility.

- 2) Training must be provided continuously to all employees working with waste and to all contract workers that might be exposed to the waste.
- 3) Members of staff must be trained to manage all types of organic waste in accordance with the provisions of these standards and any other relevant legislative requirements applicable to treatment of organic waste materials.

10. MANAGEMENT OF EMERGENCY SITUATIONS

- 1) Emergency incidents must be dealt with in accordance with Section 30 of the National Environmental Management Act, 1998 (Act No. 107 of 1198 as amended).
- 2) To minimise environmental impacts, an organic waste treatment facility must have an emergency preparedness plan which must include the following:
 - a) Hazard identification;
 - b) Prevention measures;
 - c) Emergency planning;
 - d) Emergency response;
 - e) Remedial actions.

11. OPERATIONAL MONITORING, AUDITING AND REPORTING

- 1) For the purpose of compliance monitoring, all facilities that fall within the scope as described in section 3 of these norms and standards must, prior to commencement of the construction of such facility, inform the Department for a once off registration of the facility in the Departmental database.
 - 2) The registration application referred to in section 1 above must as a minimum include the following:
 - a) the name of the owner and operator of the facility;
 - b) the geographical area where the facility is situated;
 - c) the location of the facility in terms of the name of the local municipality, erf number and geographic co-ordinates;
 - d) the size of the complete facility;
 - e) a layout plan including all operational facets of the facility;
 - f) the proximity of the facility to the nearest residential area; and
 - g) the land use zoning.
 - 3) In terms of GN 625 of NEM:WA (13 August 2012), all facilities that fall within the scope as described in section 3 of these norms and standards must, 30 days prior to commencement of the operation of such facility, apply to be registered on the SAWIS database as a treatment facility.
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- 4) A facility registered on SAWIS must provide quarterly reporting information in the format required on registration.
 - 5) The Department and any other relevant authority must be given access, to audit or inspect the site, at any time and at such frequency as the authority may decide. The audit or inspection reports by the authority must be made available to the facility owner within sixty (60) days of the audit or inspection.
 - 6) The site owner must, during the audit or inspection, make any records or documentation available to the audit or inspection team as may be required.
 - 7) A certificate of compliance with the relevant SANS standards regarding the installation of above ground or underground waste storage containers, above ground or underground supplies storage containers, processing machinery and equipment and any other infrastructure that may be used in a specified form of treatment/storage of organic waste.
 - 8) A record of any non-compliance findings by the relevant authority and the manner which non-compliance were addressed must be kept on file at the site at all times.
 - 9) Internal audits detailing environmental performance of the facility must be conducted bi-annually and official reports thereof must be prepared. Each of the internal audits must be made available to the external auditor referred to in the sub-paragraph below and to the relevant authority on request.
 - 10) External audits of the facility must be conducted annually by an independent auditor and the auditor must prepare an official audit report documenting the audit findings. The external audit report must be submitted to the Department upon request and must include but not limited to the following:
 - a) Confirmation of compliance of the facility to these standards.
 - b) Confirmation of compliance with any specific requirements issued by the relevant authority at a national, provincial or local sphere of government.
 - c) Include an interpretation of all available data and test results regarding the operation of the facility and its impacts on the environment.
 - d) Specify target dates for the implementation of any remediation or recommendations to achieve compliance.
 - e) Confirmation of any major environmental incidents that occurred and details of the manner in which the incidents were addressed.
 - f) Confirmation that hazardous waste is separated from non-hazardous waste and that hazardous waste is removed by a registered waste handling company for either recycling or disposal at a licensed disposal facility.
 - g) Confirmation of the presence of records of safe disposal certificates for all hazardous waste removed from the facility.

12. MINIMUM REQUIREMENTS DURING DECOMMISSIONING PHASE

- 11) For the purpose of decommissioning, all facilities that fall within the scope as described in section 3 of these norms and standards must, prior to closure of such facility, inform
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the Department and provide a Decommissioning plan. Where relevant the following information must be included in this plan:

- a) Timetable for staged remediation;
- b) Re-vegetation or stabilisation program; and
- c) Proposed post-closure monitoring, maintenance and use.

13. TRANSITIONAL ARRANGEMENTS

Any person who lawfully conducted an organic waste treatment facility activity in a facility that falls within the scope as described in section 3 of these standards, prior to and on the date of coming into operation of these standards may continue with the activity for the duration as stipulated in the approval, authorisation or license and after the expiry of the approval, authorisation or license comply with the provisions of these standards.

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14. ANNEXURE 1: ORGANIC WASTE TREATMENT TECHNOLOGIES

Mechanical:	
Briquetting	A briquette (or briquet) is a compressed block of coal dust or other combustible biomass material such as charcoal, sawdust, wood chips, peat, or paper used for fuel and kindling to start a fire. Biomass briquettes are a biofuel substitute to coal and charcoal.
Centrifuge	A centrifuge is a device, which employs a high rotational speed to separate components of different densities. This becomes relevant in the majority of industrial jobs where solids, liquids and gases are merged into a single mixture and the separation of these different phases is necessary. A decanter centrifuge separates solid materials from liquids in slurry and therefore plays an important role in wastewater treatment, chemical, oil and food processing industries. There are several factors that affect the performance of a decanter centrifuge and some design heuristics to be followed which are dependent upon given applications.
Chipping	Chipping is the process of reducing woody waste to smaller pieces mechanically in order to speed up decomposition of the material. Once chipped, the woody material can be used as mulch, for composting, as a fuel source or even compressed for a slower burning fuel source.
Pelleting	Compressing of organic matter to create a dense, low moisture fuel source. Pellets can be made from industrial waste and co-products, food waste, agricultural residues, energy crops, and virgin lumber.
Sonification	Sonication is the act of applying sound energy to agitate particles in a sample, for various purposes. It can aid mixing and particle dispersal as well as perform cell lysis. The process can generate heat which can result in further thermal processing.
Chemical:	
Chemical hydrolysis	Hydrolysis is a type of decomposition reaction where one reactant is water. Typically, water is used to break chemical bonds in the other

	<p>reactants. Sometimes this addition causes both substance and water molecule to split into two parts. In such reactions, one fragment of the target molecule (or parent molecule) gains a hydrogen ion.</p>
Chemical oxidation	<p>Chemical oxidation is a process involving the transfer of electrons from an oxidising reagent to the chemical species being oxidised. Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide. In water and wastewater engineering, chemical oxidation serves the purpose of converting putrescible pollutant substances to innocuous or stabilised products.</p>
Transesterification	<p>Animal and plant fats and oils are composed of triglycerides, which are esters formed by the reactions of three free fatty acids and the trihydric alcohol, glycerol. In the transesterification process, the alcohol (commonly, methanol) is added to the free fatty acids together with a base that deprotonates the alcohol so that it reacts to form fatty acid methyl ester- the main component of biodiesel.</p>
Saponification	<p>Soaps are sodium or potassium salts of long chain fatty acids. When triglycerides in fat/oil react with aqueous NaOH or KOH, they are converted into soap and glycerol. This is called alkaline hydrolysis of esters. Since this reaction leads to the formation of soap, it is called the Saponification process.</p>
Anaerobic:	
Anaerobic digestion	<p>Anaerobic digestion is a fermentation process that causes the breakdown of organic compounds without the presence of oxygen. This process reduces nitrogen to organic acids and ammonia. Carbon from organic compounds is released mainly as methane gas (CH₄). A small portion of carbon may be respired as CO₂. The decomposition occurs as four stages namely: hydrolysis, acidogenesis, acetogenesis, and methanogenesis.</p>
Aerobic:	

Aerobic digestion	Aerobic digestion is a process typically used in sewage treatment designed to reduce the volume of sewage sludge and make it suitable for subsequent use. The technology can also be applied to other organic wastes; such as food, cardboard and horticultural waste. It is a microbial process occurring in the presence of oxygen. Microbes rapidly consume organic matter and convert it into carbon dioxide, water and a range of lower molecular weight organic compounds. It is an important part of the process in composting and, when carried out optimally can generate sufficient heat to aid in destruction of pathogens (harmful bacteria and pathogens).
Black soldier fly larvae	Valorisation of organic waste through larval feeding activity of the black soldier fly, <i>Hermetia illucens</i> provides waste reduction and stabilisation while providing a product in form of the last larval stage, the so-called prepupae, which offers a valuable additive in animal feed.
Composting	A controlled biological process in which organic materials are broken down by micro-organisms in the presence of oxygen.
Vermicomposting	Vermicompost (or vermi-compost) is the product of the composting process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials, and vermicast. This process of producing vermicompost is called vermicomposting.
Thermal:	
Aqueous phase reforming	The reaction of biomass-derived oxygenated compounds (e.g. glycerol) in aqueous solution at low temperature in the presence of a platinum catalyst to produce hydrogen and light alkanes. Aqueous oxygenated hydrocarbons are reformed at low temperatures (200–250 °C) and high pressures (1.5–5 MPa).
Combustion	Combustion is a thermal process that produces heat and light energy from fire. Combustion occurs at high temperatures (generally above 1200°C) when a fuel is oxidised and for complete combustion

	<p>sufficient aeration is needed to provide an excess of oxygen. For example, when wood burns, oxygen in the air joins with carbon in wood and the carbon is oxidised to carbon-dioxide, leaving only minerals in the ash.</p>
Drying	<p>Application of heat to evaporate water from biosolids. Either direct or indirect heating methods are used. In the most common case, a gas stream, e.g., air, applies the heat by convection and carries away the vapour as humidity. Other possibilities are vacuum drying, where heat is supplied by conduction or radiation (or microwaves), while the vapour thus produced is removed by the vacuum system. Another indirect technique is drum drying (used, for instance, for manufacturing potato flakes), where a heated surface is used to provide the energy, and aspirators draw the vapour outside the room. In contrast, the mechanical extraction of the solvent, e.g., water, by centrifugation, is not considered "drying" but rather "draining".</p>
Gasification	<p>Gasification is a thermal process that converts fuel into energy rich gases; such as carbon monoxide, hydrogen (synthesis gas or syngas). This is achieved by reacting the material at moderate temperatures (>700 °C), with a limited and controlled amount of oxygen and/or steam.</p> <p>The syngas can be burned to produce electricity or further processed to manufacture chemicals, fertilizers, liquid fuels, substitute natural gas (SNG), or hydrogen.</p>
Hydrothermal Carbonisation (HTC)	<p>HTC is a thermochemical process for the conversion of organic compounds to structured carbons. It can be used to reduce the water content from the digestate / fertilizer and convert the solid fraction into "green coal" or brown coal formation (coalification). Typical hydrothermal carbonization conditions are 180oC and 1 MPa of pressure.</p>
Hydrothermal Liquefaction (HTL)	<p>Hydrothermal liquefaction of biomass is the thermochemical conversion of biomass into liquid fuels by processing in a hot, pressurized water environment for sufficient time to break down the solid biopolymeric structure to mainly liquid components. Typical</p>

	hydrothermal processing conditions are 125°C–374°C of temperature and operating pressures from 4 to 22 MPa of pressure.
Pressure heating / Supercritical water gasification (SCWG)	Mechanism using heat and pressure to improve char and lighter gases in biomass.
Pyrolysis	Pyrolysis is a thermal process that decomposes of organic material at in the absence of oxygen at temperatures of 300-600oC. It involves the simultaneous change of chemical composition and physical phase, and is derived from the Greek word for "fire separating". Pyrolysis is also known as thermal cracking, cracking, thermolysis, depolymerization, etc.
Rendering	<p>Rendering is a thermal process that converts waste animal tissue into stable, value-added materials. The rendering process simultaneously dries the material and separates the fat from the bone and protein. A rendering process yields a fat commodity (yellow grease, choice white grease, bleachable fancy tallow, etc.) and a protein meal (meat and bone meal, poultry by-product meal, etc.).</p> <p>Rendering plants often also handle other materials, such as slaughterhouse blood, feathers and hair, but do so using processes distinct from true rendering.</p>
Torrefaction	A thermal process to convert biomass into a coal-like material, which has better fuel characteristics than the original biomass. Torrefied biomass is more brittle, making grinding easier and less energy intensive.

15. ANNEXURE 2: ITEMS TO BE INCLUDED IN A STANDARD OPERATING PROCEDURE

Principle Component	Subsection
Siting	<ul style="list-style-type: none"> • locality map showing the siting of the facility and location of environmentally sensitive areas, including residential zones, dwellings, schools and hospitals • ground plan of facility, including location of monitoring points/equipment • natural characteristics of site (local meteorology (wind and rain patterns), soil morphology, geology, hydrogeology and surface waters) • facility environmental policy (including protection of environmentally sensitive areas) • business plans (type and quantity of organics to be processed now and in future, and type and quality of products) • staffing (organisation, headcount, skills, responsibilities, training and proposed working hours) • zoning of the site must be consistent with the local authority requirements
Water management	<ul style="list-style-type: none"> • surface water controls • leachate controls and handling • water monitoring and assessment • leachate monitoring and assessment • contaminated water remediation
Gas and odour management	<ul style="list-style-type: none"> • process controls and monitoring • odour and weather monitoring • management of rapidly biodegradable organics • gas containment and extraction (where applicable) • gas monitoring • remediation of uncontrolled gas emissions • gas oxidation controls and monitoring
Incoming organics management	<ul style="list-style-type: none"> • screening and recording of organics received • organics handling and storage
Product quality assurance	<ul style="list-style-type: none"> • feedstock selection • process controls and monitoring • product testing and monitoring – physical, chemical and biological • management of contaminated organics and products
Noise management	<ul style="list-style-type: none"> • scheduling of the operation of noisy equipment and heavy transport

	<p>vehicles</p> <ul style="list-style-type: none">• noise monitoring
Housekeeping practices	<ul style="list-style-type: none">• dust and litter control• pest, weed and vermin control• site security• disposal of wastes and contaminated products• maintenance of facility and equipment• stock controls
Fire-fighting and prevention	<ul style="list-style-type: none">• fire prevention• fire-fighting provisions
Monitoring	<ul style="list-style-type: none">•The site must be inspected on a daily basis to ensure early detection and addressing of environmental pollution.•All monitoring data must be kept up to date and made available on request.

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16. ANNEXURE 3: GENERAL REQUIREMENT FOR ORGANIC WASTE TREATMENT FACILITIES

Technology	Transport	Storage & Handling	Pre-treatment	Operation	Residue / Product
Mechanical					
Briquette Centrifuge Chipping Pelleting Sonification	<p>-Mobile plants minimise transportation impacts</p> <p>-All vehicles must be regularly maintained and roadworthy</p> <p>-Ensure emissions filters are fitted on vehicles and machinery</p> <p>-Potentially use rail for transport if possible</p> <p>-Cover dusty materials during transit</p>	<p>-Storage must comply with the Waste Storage N&S</p> <p>-Storage on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas</p> <p>-Minimising, containing and re-using contaminated stormwater and leachate so there is no discharge of contaminated wastewater from the premises</p> <p>-No long term storage i.e. feedstock must be used within 90 days</p> <p>- The quantity of Category 2 and Category 3 organics awaiting processing should not exceed one day's production, unless it is stored in a manner that prevents the release of odours</p> <p>-Good housekeeping on site to prevent pests and malodours</p> <p>-Correct management of stock piles to prevent fires</p> <p>-Avoid shredding on windy days</p>	<p>-Pre- treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas.</p> <p>-Good housekeeping on site to prevent pests and malodours</p> <p>-Install and maintain silencers on vehicles and equipment</p> <p>-Provide noise attenuation screens such as earth berms or trees</p> <p>-Restrict operating hours</p> <p>-Maintain designated buffer distances where applicable</p> <p>-Provide fire safety protocol</p>	<p>-Ensure aeration of material to prevent methane generation, unless specifically required</p> <p>-Prevent waterlogging</p> <p>-Treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas</p> <p>- Minimising, containing and re-using wastewater so there is no discharge of contaminated wastewater from the premises</p> <p>-Good housekeeping on site to prevent pests and malodours</p> <p>-Install and maintain silencers on vehicles and equipment</p> <p>-Where possible, noisy equipment should be housed within a building or similar structure</p> <p>-Provide noise attenuation screens such</p>	<p>-Prevent waterlogging of finished product</p> <p>-Cover dusty materials</p> <p>-Product must be stored on an impermeable surface</p> <p>-Increase dry matter content to minimise leachate.</p>

Technology	Transport	Storage & Handling	Pre-treatment	Operation	Residue / Product
		<ul style="list-style-type: none"> -Ensure good record keeping for type and volume of feedstock entering the premises -Increase dry matter content to minimise leachate. 		<ul style="list-style-type: none"> as earth berms or trees -Restrict operating hours -Maintain designated buffer distances where applicable -Provide fire safety protocol 	
Chemical					
Chemical hydrolysis	-Mobile plants minimise transportation impacts	-Storage must comply with the Waste Storage N&S	-Pre- treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas.	-Storage of chemicals must be done in terms of the Hazardous Substances Act	-Prevent waterlogging of soil with digestate
Chemical oxidation	-All vehicles must be regularly maintained and roadworthy	-Storage on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas	-Good housekeeping on site to prevent pests and malodours	-Treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas	-Avoid over fertilising soils
Transesterification	-Ensure emissions filters are fitted on vehicles and machinery	-Minimising, containing and re-using contaminated stormwater and leachate so there is no discharge of contaminated wastewater from the premises	-Install and maintain silencers on vehicles and equipment	- Minimising, containing and re-using wastewater so there is no discharge of contaminated wastewater from the premises	-Compliance with DWS & DAFF guidelines for use of organic fertilisers to soil
Saponification	-Potentially use rail for transport if possible -Cover dusty materials during transit	-No long term storage i.e. feedstock must be used within 90 days - The quantity of Category 2 and Category 3 organics awaiting processing should not exceed one day's production, unless it is stored in a manner that prevents the release of odours	-Provide noise attenuation screens such as earth berms or trees -Restrict operating hours -Maintain designated buffer distances where applicable	-Good housekeeping on site to prevent pests and malodours -Install and maintain silencers on vehicles and equipment -Where possible, noisy	-Storage of biofuels must not lead to leachates polluting soils or waterways -Product must be stored on an impermeable surface -Increase dry matter content to minimise leachate.

Technology	Transport	Storage & Handling	Pre-treatment	Operation	Residue / Product
		<ul style="list-style-type: none"> -Good housekeeping on site to prevent pests and malodours -Correct management of stock piles to prevent fires -Avoid shredding on windy days -Ensure good record keeping for type and volume of feedstock entering the premises 	<ul style="list-style-type: none"> -Provide fire safety protocol 	<ul style="list-style-type: none"> equipment should be housed within a building or similar structure -Provide noise attenuation screens such as earth berms or trees -Restrict operating hours -Maintain designated buffer distances where applicable -Provide fire safety protocol 	
Anaerobic					
Anaerobic digestion	<ul style="list-style-type: none"> -Mobile plants minimise transportation impacts -All vehicles must be regularly maintained and roadworthy -Ensure emissions filters are fitted on vehicles and machinery -Potentially use rail for transport if possible -Cover dusty materials during transit 	<ul style="list-style-type: none"> -Storage must comply with the Waste Storage N&S -Storage on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas -Minimising, containing and re-using contaminated stormwater and leachate so there is no discharge of contaminated wastewater from the premises -No long term storage i.e. feedstock must be used within 90 days - The quantity of Category 2 and Category 3 organics 	<ul style="list-style-type: none"> -Pre- treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas. -Good housekeeping on site to prevent pests and malodours -Install and maintain silencers on vehicles and equipment -Provide noise attenuation screens such as earth berms or trees 	<ul style="list-style-type: none"> -Treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas - Minimising, containing and re-using wastewater so there is no discharge of contaminated wastewater from the premises -Good housekeeping on site to prevent pests and malodours -Install and maintain silencers on vehicles and equipment 	<ul style="list-style-type: none"> -Prevent waterlogging of soil with digestate -Avoid over fertilising soils -Compliance with DWS & DAFF guidelines for use of organic fertilisers to soil -Product must be stored on an impermeable surface -Increase dry matter content to minimise leachate.

Technology	Transport	Storage & Handling	Pre-treatment	Operation	Residue / Product
		<p>awaiting processing should not exceed one day's production, unless it is stored in a manner that prevents the release of odours</p> <p>-Good housekeeping on site to prevent pests and malodours</p> <p>-Correct management of stock piles to prevent fires</p> <p>-Ensure good record keeping for type and volume of feedstock entering the premises</p> <p>-Increase dry matter content to minimise leachate.</p>	<p>-Restrict operating hours</p> <p>-Maintain designated buffer distances where applicable</p> <p>-Provide fire safety protocol</p>	<p>-Where possible, noisy equipment should be housed within a building or similar structure</p> <p>-Provide noise attenuation screens such as earth berms or trees</p> <p>-Restrict operating hours</p> <p>-Maintain designated buffer distances where applicable</p> <p>-Provide fire safety protocol</p>	
Aerobic					
<p>Aerobic digestion</p> <p>Black soldier fly larvae</p> <p>Composting</p> <p>Vermicomposting</p>	<p>-Mobile plants minimise transportation impacts</p> <p>-All vehicles must be regularly maintained and roadworthy</p> <p>-Ensure emissions filters are fitted on vehicles and machinery</p> <p>-Potentially use rail for transport if possible</p> <p>-Cover dusty materials during transit</p>	<p>-Storage must comply with the Waste Storage N&S</p> <p>-Storage on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas</p> <p>-Minimising, containing and re-using contaminated stormwater and leachate so there is no discharge of contaminated wastewater from the premises</p> <p>-No long term storage i.e. feedstock must be used within 90 days</p>	<p>-Pre- treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas.</p> <p>-Good housekeeping on site to prevent pests and malodours</p> <p>-Install and maintain silencers on vehicles and equipment</p> <p>-Provide noise attenuation screens such</p>	<p>-Ensure aeration of material to avoid methane generation</p> <p>-Prevent waterlogging</p> <p>-Treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas</p> <p>- Minimising, containing and re-using wastewater so there is no discharge of contaminated wastewater from the premises</p>	<p>-Prevent waterlogging of soil with digestate</p> <p>-Avoid over fertilising soils</p> <p>-Compliance with DWS & DAFF guidelines for use of organic fertilisers to soil</p> <p>-Compliance with DAFF guidelines for feed protein in livestock</p> <p>-Product must be stored on an impermeable surface</p> <p>-Increase dry matter content to minimise leachate.</p>

Technology	Transport	Storage & Handling	Pre-treatment	Operation	Residue / Product
		<ul style="list-style-type: none"> - The quantity of Category 2 and Category 3 organics awaiting processing should not exceed one day's production, unless it is stored in a manner that prevents the release of odours -Good housekeeping on site to prevent pests and malodours -Correct management of stock piles to prevent fires -Avoid shredding on windy days -Ensure good record keeping for type and volume of feedstock entering the premises -Increase dry matter content to minimise leachate. 	<ul style="list-style-type: none"> as earth berms or trees -Restrict operating hours -Maintain designated buffer distances where applicable -Provide fire safety protocol 	<ul style="list-style-type: none"> -Good housekeeping on site to prevent pests and malodours -Install and maintain silencers on vehicles and equipment -Where possible, noisy equipment should be housed within a building or similar structure -Provide noise attenuation screens such as earth berms or trees -Restrict operating hours -Maintain designated buffer distances where applicable 	
Thermal					
Aqueous phase reforming	-Mobile plants minimise transportation impacts	-Storage must comply with the Waste Storage N&S	-Pre- treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas.	-Ensure that air scrubbers are utilised for technologies where gas capture cannot take place (combustion & drying)	-Prevent waterlogging of soil with digestate
Combustion	-All vehicles must be regularly maintained and roadworthy	-Storage on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas	-Good housekeeping on site to prevent pests and malodours	-Treatment must take place on impermeable surfaces (concrete, clay or heavy duty plastic) with run off collection areas	-Avoid over fertilising soils
Drying		- Minimising, containing and re-using contaminated stormwater and leachate so there is no discharge of contaminated wastewater from the premises	-Install and maintain		-Compliance with DWS & DAFF guidelines for use of organic fertilisers to soil
Gasification	-Ensure emissions filters are fitted on vehicles and machinery				-Storage of biofuels must not lead to leachates polluting soils or waterways
Hydrothermal carbonisation (HTC)	-Potentially use rail for transport if possible				

Technology	Transport	Storage & Handling	Pre-treatment	Operation	Residue / Product
Hydrothermal liquefaction (HTL) Pressure heating Pyrolysis Rendering Torrefaction	<ul style="list-style-type: none"> -Cover dusty materials during transit 	<ul style="list-style-type: none"> -No long term storage i.e. feedstock must be used within 90 days - The quantity of Category 2 and Category 3 organics awaiting processing should not exceed one day's production, unless it is stored in a manner that prevents the release of odours -Good housekeeping on site to prevent pests and malodours -Correct management of stock piles to prevent fires -Avoid shredding on windy days -Ensure good record keeping for type and volume of feedstock entering the premises 	<ul style="list-style-type: none"> silencers on vehicles and equipment -Provide noise attenuation screens such as earth berms or trees -Restrict operating hours -Maintain designated buffer distances where applicable -Provide fire safety protocol 	<ul style="list-style-type: none"> - Minimising, containing and re-using wastewater so there is no discharge of contaminated wastewater from the premises -Good housekeeping on site to prevent pests and malodours -Install and maintain silencers on vehicles and equipment -Where possible, noisy equipment should be housed within a building or similar structure -Provide noise attenuation screens such as earth berms or trees -Restrict operating hours -Maintain designated buffer distances where applicable -Provide fire safety protocol 	<ul style="list-style-type: none"> -Product must be stored on an impermeable surface