

Treatment operations

Lists of treatment operations are set out in Annex I (Disposal operations) and Annex II (Recovery operations) of the Waste Framework Directive (Directive 2008/98/EC.) (WFD).

The lists of R(ecovery) and D(isposal) operations build the basis for the breakdown of data by treatment categories that have to be reported by the Member States to Eurostat. The recovery and disposal operations that are pre-treatment operations and that are therefore excluded from reporting under the Waste Statistics Regulation, are shaded grey.

Code	Disposal operation	Explanation and Common Examples
D 1	Deposit into or on to land.	Landfilling (even when landfill gas is used for energy recovery), including: <ul style="list-style-type: none"> landfills for inert waste, non-hazardous waste and hazardous waste above ground. landfills for the underground storage of waste.
D 2	Land treatment (e.g. biodegradation of liquid or sludgy discards in soils, etc.)	<ul style="list-style-type: none"> D2 means the spreading of waste on land, often followed by the incorporation of the waste into the soil. Land treatment activities are assigned to D2 if the treatment constitutes a disposal operation and does not result in benefit to agriculture or other ecological improvements. In practice, land treatment within the meaning of D2 is deployed for non-hazardous sludge and for liquid wastes, e.g. for the disposal of dredging sludge.
D 3	Deep injection (e.g. injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.)	D3 means the injection of waste into natural or artificial cavities, or into porous formations of rock.
D 4	Surface impoundment (e.g. placement of liquid or sludgy discards into pits, ponds or lagoons, etc.)	This is, for instance, the predominant method for the management of tailings in mining operations (e.g. in the metal mining sector and in certain coal extraction industries).
D 5	Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)	Landfilling
D 6	Release into a water body except seas/oceans	D6/7 is restricted by law to only a few types of waste and includes: <ul style="list-style-type: none"> the deposit of non-hazardous dredging sludge and other non-hazardous sludge in surface water including the bed and the subsoil; the discharge of waste at sea in accordance with the OSPAR
D 7	Release to seas/oceans including sea-bed insertion	

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		Convention (e.g. the discharge of fish processing waste and inert materials of natural origin).
D 8	Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12	<ul style="list-style-type: none"> Biological treatment comprises operations which use aerobic or anaerobic biological processes in order to prepare the waste for subsequent disposal, e.g. by reducing the amount of biodegradable components, or by degradation of organic pollutants. This includes, in particular: <ul style="list-style-type: none"> biological-mechanical treatment of municipal waste; biological treatment of contaminated soil, sludges or mineral wastes, if followed by disposal.
D 9	Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.)	<ul style="list-style-type: none"> Chemical-physical treatment covers the pre-treatment of mainly fluid and pasty hazardous waste by a variety of chemical, thermal and physical processes in order to achieve an output which can be disposed of. Physico-chemical treatment is typically deployed for: <ul style="list-style-type: none"> emulsions and oil/water mixtures; neutral aqueous organics and inorganics (production specific waste water, leachate, etc.); cyanides; acids and alkalis. Typical treatment steps are detoxification (oxidation/reduction), precipitation, neutralisation, emulsion separation, immobilisation, electrolysis and osmosis.
D 10	Incineration on land	<ul style="list-style-type: none"> MW incineration facilities that do not fulfil the energy efficiency standards set in Annex II of the WFD Dedicated waste incineration plants for combustion of non-MW waste, where the main purpose of the operation is the thermal treatment of the waste and not the production of energy. Hazardous waste incineration plants. Sewage sludge incineration plants. Incineration plants for clinical waste. Incineration plants for animal carcasses.

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D 11	Incineration at sea	This treatment option is banned by international agreements
D 12	Permanent storage (e.g. emplacement of containers in a mine, etc.)	Landfilling
D 13	Blending or mixing prior to submission to any of the operations numbered D 1 to D 12.	<ul style="list-style-type: none"> Blending, mixing and repackaging of waste covers similar preparatory activities whose purpose is the conditioning and packaging of waste for subsequent transport and further treatment. Such operations typically include: <ul style="list-style-type: none"> basic sorting activities; crushing and shredding of waste in order to reduce the volume of waste for transport or landfilling; mixing and blending of waste (e.g. mixing of similar wastes from different waste generators); homogenisation, conditioning and solidification; packaging of asbestos; transfer and compaction of waste.
D 14	Repackaging prior to submission to any of the operations numbered D 1 to D 13	
D 15	Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage, pending collection, on the site where the waste is produced)	<ul style="list-style-type: none"> Temporary storage covers the temporary storage of waste prior to disposal. Temporary storage does not involve the storage of waste prior to collection at the site at which it was generated. Temporary means that the storage is limited to a period of less than one year.

Code	Recovery operation	Examples
R1	Use principally as a fuel or other means to generate energy	<ul style="list-style-type: none"> Incineration or co-incineration with energy recovery (so that the resultant energy can be used to generate heat or electricity. MW incineration facilities that fulfil the energy efficiency standards set in Annex II of the WFD The use of waste as fuel for energy production Common examples of energy recovery are: <ul style="list-style-type: none"> the use of tyres, waste oils, or spent solvents in

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		<ul style="list-style-type: none"> ○ cement kilns; ○ the co-incineration of sewage sludge or refuse-derived fuel (RDF) from municipal waste in power stations
R2	Solvent reclamation/regeneration	<p>All treatment activities, whose purpose is the regeneration or recovery of spent solvents, e.g.:</p> <ul style="list-style-type: none"> ▪ re-refining of solvents in order to separate contaminants and to restore the solvent to its original quality or to a lower grade product (e.g. lacquer thinner); ▪ preparation of secondary liquid fuels (SLF)
R3	Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)	<ul style="list-style-type: none"> ▪ All operations whose purpose is the recovery of biodegradable and non-biodegradable organic materials. This also includes gasification and pyrolysis using the components as chemicals. ▪ These operations include the following, in particular: <ul style="list-style-type: none"> ○ Recycling of waste paper and board in a paper factory ○ Reprocessing and recycling of plastic waste; ○ Composting ○ Fermentation of biodegradable waste for biogas production (biogas plants).
R4	Recycling/reclamation of metals and metal compounds	<ul style="list-style-type: none"> ▪ All treatment operations whose purpose is the recycling of metal waste, and of complex products with metals as the predominant material. ▪ These treatment operations include a variety of mechanical, thermal and chemical treatment steps and processes, such as the following: <ul style="list-style-type: none"> ○ recycling of scrap and production waste in steelworks; ○ shredding and reprocessing of end-of-life vehicles and waste electrical and electronic equipment; ○ thermal treatment of cables or oil-contaminated metals; ○ battery recycling; ○ electrolytic recovery of silver from photo chemicals.
R5	Recycling/reclamation of other inorganic materials	<ul style="list-style-type: none"> ▪ All treatment operations whose purpose is the recovery of inorganic non-metal wastes and which are not covered by other more specific operations (e.g. R6, R8, R10).

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		<ul style="list-style-type: none"> ▪ Inorganic non-metal wastes represent a large proportion of the total waste generated and consist of a broad spectrum of waste types. The main groups are: <ul style="list-style-type: none"> ○ waste from thermal processes (slag, ashes, sands, dust, etc.) ○ construction and demolition waste ○ waste from mining and quarrying. ▪ The treatment processes applied are manifold and include the following, for example: <ul style="list-style-type: none"> ○ reprocessing and recycling of construction and demolition waste; ○ reprocessing and recycling of glass waste in a glass factory; ○ use as secondary raw material in cement kilns; ○ asphalt mixing plants using mineral wastes; ○ soil cleaning resulting in recovery of the soil
R6	Regeneration of acids or bases	<ul style="list-style-type: none"> ▪ R6 comprises operations whose purpose is the regeneration and subsequent reuse of spent acids/bases for the original purpose or for other purposes. ▪ Such operations include: <ul style="list-style-type: none"> ○ the re-concentration of spent acids; ○ the thermal decomposition of spent sulphuric acid for use as feedstock in sulphuric acid production.
R7	Recovery of components used for pollution abatement	<ul style="list-style-type: none"> ▪ R7 includes treatment operations whose purpose is the regeneration of pollution abatement materials such as activated carbon and ion exchange resins. ▪ Common applications are: <ul style="list-style-type: none"> ○ the regeneration of activated carbon from water purification and flue gas treatment, mainly by thermal treatment; ○ the regeneration of resins by solvent washing.
R8	Recovery of components from catalysts	<p>R8 covers treatment operations whose purpose is:</p> <ul style="list-style-type: none"> ▪ the regeneration of catalysts to be reused as catalysts; ▪ the recovery of catalyst components, mainly of metal

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		components, e.g. recycling of precious metals from catalytic converters in vehicle exhausts.
R9	Oil re-refining or other reuses of oil	<p>The two main options are:</p> <ul style="list-style-type: none"> the re-refining of waste oil, converting waste oils into base oils which can be used to manufacture lubricating products. The treatment typically includes distillation, treatment with acids, solvent extraction, contact with activated clay and hydrotreating. the preparation of fuels from waste oils, which can be used as a substitute for, for example, coal, diesel and light fuel. This usually involves the separation of solids and water, e.g. by heating, filtering, dehydrating and centrifuging.
R10	Land treatment resulting in benefit to agriculture or ecological improvement	<ul style="list-style-type: none"> R10 comprises: <ul style="list-style-type: none"> the use of organic and mineral wastes as fertilisers or soil conditioners in agriculture; other applications of waste on land on which no food and feed crops are cultivated, and which result in ecological improvement such as landscape restoration and restoration of old disused quarries. In practice, the following land treatments are assigned to R10: <ul style="list-style-type: none"> the use of sewage sludge in agriculture in compliance with the Sewage Sludge Directive; the spreading on land of compost from the treatment of separately collected biowaste; the use of manure in compliance with agricultural regulations; the use of mineral wastes as fertilisers in compliance with national legislation.
R11	Use of waste obtained from any of the operations numbered R 1 to R 10	R11 comprises the recovery of residual waste from previous recovery operations. It is a redundant entry as it covers only treatment operations that could also be assigned to one of the more specific codes R2 to R10. Priority should be given to the most specific assignment.
R12	Exchange of waste for submission to any of the operations numbered R 1 to R	<ul style="list-style-type: none"> If there is no other R code appropriate, this can include

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	11	<p>preliminary operations prior to recovery including pre-processing such as, inter alia, dismantling, sorting, crushing, compacting, pelletising, drying, shredding, conditioning, repackaging, separating, blending or mixing prior to submission to any of the operations numbered R1 to R11.</p> <ul style="list-style-type: none"> ▪ Common examples of preparatory treatment activities include: <ul style="list-style-type: none"> ○ basic sorting activities; ○ mixing of waste from different generators before it is sent to a recovery facility; ○ transfer and compaction of waste; ○ shredding of wood waste prior to energy recovery.
R13	Storage of waste pending any of the operations numbered R 1 to R 12 (excluding temporary storage, pending collection, on the site where the waste is produced)	<ul style="list-style-type: none"> ▪ Temporary storage covers the temporary storage of waste prior to recovery. ▪ This does not involve the storage of waste prior to collection at the site at which it was generated. ▪ Temporary means that the storage is limited to a period of less than three years.