**BAT on storage of hazardous and non-hazardous waste: A short guide**

*Project MK-10-IB-EN-01*

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**List of Acronyms**

|  |  |
| --- | --- |
| ADR  BATs | European Agreement concerning the International Carriage of Dangerous Goods by Road  Best Available Techniques |
| BREFs  ELV  EWC  ICAO  IMDG  WAC | Best Available Techniques Reference Document  Emission Limit Values  European Waste Catalogue  International Civil Aviation Organisation  International Maritime Dangerous Goods Code  Waste Acceptance Criteria |
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# Introduction

The objective of this document is to give a short overview of techniques/measures which can be considered as Best Available Technique (BAT) for the storage of wastes. The main focus is on the storage of hazardous wastes which constitute, if not properly handled, a severe threat to the environment.

Generally BREF documentation (BREF “Emissions from Storage”[[1]](#footnote-1)) about storage facilities does not specify between storage of liquid/ solid goods and waste. Therefore only some general information/BAT guidance on general precaution measures has been extracted and used here. Any additional information (i.e. about characteristics of facilities, operational measures, etc.) were taken from existing best practices in EU Member States as well as from practical experience (and enforcing of legislation) in inspection/monitoring of waste management systems and facilities. As a matter of fact the proper organisation of the procedures around the whole storage process are considered as applicable BAT (chapters 3, 4 and 5 of this document).

A short guidance on the elements to be inspected is given in chapter 6.

# Waste classification: which are hazardous/non-hazardous wastes?

The main reference document for the characterisation of a waste is the European Waste Catalogue (EWC) where substances marked by an asterisk (\*) are considered as hazardous.

The classification into hazardous and non-hazardous waste is based on the system for the classification and labelling of dangerous substances and preparations, which ensures the application of similar principles over their whole life cycle. The properties which render waste hazardous are laid down in Annex III of Directive 2008/98/EC and are further specified by the Decision 2000/532/EC establishing a List of Wastes as last amended by Decision 2001/573/EC.

Hazardous/non- hazardous wastes are generated from the following major sectors/activities:

1. Wastes resulting from exploration, mining, quarrying, physical and chemical treatment of minerals
2. Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing
3. Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard
4. Wastes from the leather, fur and textile industries
5. Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal
6. Wastes from inorganic chemical processes
7. Wastes from organic chemical processes
8. Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks
9. Wastes from the photographic industry
10. Wastes from thermal processes
11. Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy
12. Wastes from shaping and physical and mechanical surface treatment of metals and plastics
13. Oil wastes and wastes of liquid fuels (except edible oils, 05 and 12)
14. Waste organic solvents, refrigerants and propellants (except 07 and 08)
15. Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified
16. Wastes not otherwise specified in the list
17. Construction and demolition wastes (including excavated soil from contaminated sites)
18. Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)
19. Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use
20. Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions.

Generally wastes can be classified as:

1. Wastes that may be hazardous or non-hazardous ( known as “mirror hazardous” and *“*mirror non-hazardous”)
2. Wastes that are always hazardous ( known as “absolute hazardous”)
3. Wastes that are always non-hazardous (known as “absolute non-hazardous”).

Within the framework of this project a guidance for the classification and characterization of mirror wastes has been developed in a separate document.

# Storage of wastes

Storage facilities can be classified into two (2) main categories i.e. storage of liquids and liquefied gases and of solid wastes.

There are several devices applicable for storing liquids/liquefied gases (Table 1).

Table 1: Devices for the storage of liquids/liquefied gases

|  |  |
| --- | --- |
| **Type of storage mode** | **Atmospheric, pressurised, refrigerated** |
| Open top storage tanks | Atmospheric |
| External floating roof tanks | Atmospheric |
| (Vertical) fixed roof tanks | Atmospheric |
| Horizontal storage tanks (aboveground) | Atmospheric |
| Horizontal storage tanks (underground) | Atmospheric |
| Variable vapour space tanks | Atmospheric |
| Spheres | Pressurised |
| Horizontal storage tanks | Pressurised |
| Vertical cylindrical tanks | Pressurised |
| Mounded storage | Pressurised |
| Refrigerated storage tanks | Refrigerated |
| Caverns | Atmospheric |
| Caverns | Pressurised |
| Caverns – salt leached |  |
| Containers and storage of containers | |
| Basins and lagoons | Atmospheric |
| Floating storage | Atmospheric |

For the storage of solids, excluding the open storage, sacks/bulked bags, silos/bunkers and specific package of dangerous goods are usually applied.

The above are general storage methods applicable to goods as well as to liquid/solid wastes. The main focus should however be towards the storage methods for hazardous wastes due to the fact that any leakage from the relevant facilities will have significant adverse impacts to the environment. In this context any measures aiming at the avoidance of any leakage/release of dangerous emissions from the storage facilities (such as tanks, caverns, silos/bunkers etc.) can be considered as BAT.

# BAT consideration for the storage of hazardous wastes

## Siting

The location of a storage facility shall be chosen in such a way that:

* It is easily accessible for firefighting and other emergency procedures
* The site is not subject to flooding and heavy storms
* The potential for environmental hazards to the quality of surface/ground waters is kept to a minimum

## Building characteristics/requirements

* The storage facility must be located at a safe distance to the storage places of raw materials, products and to the actual production process units
* The construction of the building should secure that stored wastes are protected from heavy rain, floods, fire incidents etc.
* Facility’s basement has to be inclined and equipped with run-off collection pipelines
* It shall be avoided that any feeding pipelines are located underground so that any corrosion incidents can be early detected and repaired
* Safe distance of the storage area from water feeding pipelines, sewers and wastewater treatment plants must be kept
* Sufficient aeration and lighting of the storage facility must be secured
* Safety precautions (firefighting, setting up of escape routes) have to be incorporated in the design of the storage facilities.

## Safety precautions in storage facilities

* Substances incompatible to each other have to be segregated/separated before their final storage
* The storage facility as well as the storage/packaging devices (tanks, containers, bags etc.) must be marked according to international classification systems i.e. the UN classification system, the European Agreement concerning the International Carriage of Dangerous Goods by Road – ADR, International Maritime Dangerous Goods Code (IMDG) and International Civil Aviation Organisation (ICAO)
* Escape routes, emergency exits and firefighting equipment places must be clearly marked
* Shading devices or painting of glass surfaces must be performed in order to avoid any deterioration of stored wastes
* Positioning of lightning rods is essential in case that they are not installed elsewhere in the facility
* Control/alarm systems for leakage detection/fire accident have also to be installed

## Storage tanks

In case of bulk storage of hazardous wastes in tanks the following measures can be considered as BAT:

* The tanks are made either of concrete, sealed either with plastic or metallic cover, or they can be metallic sealed accordingly
* Open tanks are always placed in a covered area and surrounded by a leakage collection system able to handle at least 30% of the tanks’ capacity
* Aeration systems, level indicators as well as safety devices against overflowing and/or overpressure must be installed
* In case of storage of flammable wastes fixed roof tanks have to be used (instead of open tanks)
* In case of storage of toxic (T), very toxic (T+) or carcinogenic/mutagenic substances the fixed roof tanks must also be equipped with a vapour treatment installation; for other substances an internal floating roof (direct contact or non-contact) can be installed
* Aboveground tanks in which volatile substances are stored have to be painted with a colour assuring a reflectivity of thermal or light radiation of at least 70 %; they can also be equipped with a solar shield

# Operation of the storage facilities

## Acceptance of delivered wastes

The operator can accept any waste delivered to the facility if:

* The storage facility’s permit clearly foresees the acceptability of the waste (to be delivered)
* The accompanying documents of each load (e.g. consignment note) are properly filled in and the delivered quantities are identical with those stated in the consignment note

## Management of incidents, overpassing of limit values

* In case of incidents which lead to violation of the set emission limit values, the operator has to immediately inform the relevant authorities; any recuperation measures have to be immediately implemented
* In cases of accidents the operator has to immediately cease the facility’s operation and inform the relevant authorities about the incident; in any case the facility will not be operational up to the moment when the authorities will allow it (after inspection)

## Operation’s handbook

A document describing how the proper operation of the storage facility will be maintained has to be drafted and followed accordingly by all those persons who are involved in the overall storage process.

It should contain:

* The obligations/duties of all employees of the facility
* How any other persons (i.e. users/visitors, transporters, clients) shall behave when entering the facility
* A plan of the facility containing
* A design plan of all installations of the facility
* Types of wastes accepted/stored
* Maximum permissible waste quantities
* Applicable security measures for employees/visitors
* Security plan of the facility

## Reporting obligations

The operator has to keep and continuously update a register of the collected/stored waste quantities. On an annual basis he has to prepare a report which has to be submitted to the relevant authorities containing:

* General information about the facility (name/address, operator’s name)
* Types and quantities of stored wastes
* Quantities of in/out wastes per year – destinations of out coming wastes
* Operational plan + relevant operational checks
* Measures to combat eventual pollution incidents
* Measuring systems for emissions
* Equipment maintenance measures
* Cases of surpassing ELV – recuperation measures
* Any checks of the facility performed by accredited/certified institutions

# Closure of a storage facility

In case that a storage facility will be closed (for any reason) the operator has to report to the relevant authorities the following information:

* Description of the facility (place, types/quantities of wastes stored over the past years)
* Any pollution incidents occurred in the past
* Depollution (removal-treatment of pollutants)/final cleaning (washing/drying)/dismantling of equipment
* The activities/measures implemented for the restoration of the area

# The inspection

## Preparation before the inspection

### Decide on type/duration of inspection

The inspection team has to decide about:

* The kind of the inspection i.e. routine inspection or extraordinary (on the basis of complaints)
* The resources needed (man-power/equipment, safety precautions)
* The practical arrangements i.e. time/duration of inspection, weather conditions

### Desk study

The collection and evaluation of existing information about the installation is critical for the success of the inspection since it allows the easier formulation of targeted questions for the interview of the operator and the concrete investigation of those unit operations which show the highest potential for non-compliance with the permit conditions. Examples of information to be collected are listed below:

1. Reports of previous inspections of the site
2. The existing permit
3. Environmental Impact Assessment studies available for the site
4. Environmental reports submitted by operators
5. Complaints received about the installation
6. BREF – Emissions from Storage (chapters 3.1, 3.3, 5.1.)
7. Information on the installation to be inspected received from other competent authorities

On the basis of the evaluation of the collected information the following has to be prepared:

* A comprehensive questionnaire which will be used for the operator’s interview
* An outline of the “critical” issues to be discussed with the operator (e.g. safety precautions, packaging of dangerous substances, harmful incidents occurred etc.)
* The list of documentation to be provided by the operator (e.g. annual reports submitted to the authorities)
* The inspection report template (tailor-made for the installation) to be filled in at the end of the inspection
* Agenda of inspection.

## On site inspection

The operating/environmental conditions set in the issued permit will be the „guidance” throughout the inspection.

### Main questions for inspection

#### Critical issues to be inspected

1. **Safety precautions**

* Check whether the marking of storage facilities and of packaging devices of hazardous wastes is made according to the international standards
* Inspect the marking/visibility of escape routes, the safe placing of firefighting equipment
* Inspect the storage units within the facility to understand to which extent incompatible (to each other) wastes are properly segregated
* Check the positioning of lightning rods (if needed: eventually rods could have been installed in other places but they are sufficient for the facility as well)
* Check the level of operability of the alarm systems (leakage/fire)

1. **Storage tanks (if any)**

* Check whether flammable liquids are stored properly (fixed roof tanks)
* Check whether proper leakage collection systems are placed around open tanks and where any leakages are discharged (treatment plant?)
* If carcinogenic or other hazardous wastes are stored in tanks the installation and proper operation of a vapour treatment system has to be checked

1. **Overall management of the facility**

* Check the existence of a regulation/handbook for the facility’s operation and to which extent it is updated
* Check the consignment notes delivered to the facility: they will give an insight to the types and quantities of hazardous wastes delivered to the installation and must be identical with the quantities’ register of the facility (as a matter of fact this task is essential to reduce/ban the illegal transport/market of waste) – check incoming/outgoing waste quantities: they must be identical with the delivered consignment notes! – check facility’s register
* On the basis of the information of the annual reports (desk study) and in case of occurred incidents of pollution/fire inspect to which extent the operator has taken the necessary measures to combat similar incidents in the future
* Check the operational level of emissions detecting devices.

## After the inspection

### Inspection reporting

At the end of the inspection and returning back to the Inspectorate’s offices a report has to be prepared which shall contain 3 main parts:

1. Baseline of the inspection

* Inspection basis (permit, legal regulations)
* Competent inspection authority, cooperating inspection authorities
* Kind of installation (storage of hazardous wastes)
* Operator (Name of the company)
* Address
* Date of inspection
* Length of inspection time
* Scope of the inspection (e. g. integrated inspection, media that were inspected, parts of the installation that were inspected)
* Expected or unexpected inspection

1. Inspection’s results

* No or only minor non-compliances
* Significant or relevant non-compliances
* Serious or important non-compliances

1. Recommended corrective measures

* No or only corrective measures
* Significant or relevant corrective measures
* Serious or important corrective measures

### Inspection recording

The inspection report and any other additional material used for the preparation of the inspection can be stored and made accessible to any relevant authorities for their information.

# Non-hazardous wastes

A common practice, in particular in most south eastern European countries, is to dispose directly non-hazardous wastes (as characterised by their national waste codes and the EWC) into landfills without any extensive intermediate storage. In doing so, the waste acceptance criteria (WAC) described in the EU Council Decision 2003/33/EC must be met.

In general a landfill site for non-hazardous waste can accept municipal waste along with non-hazardous wastes (including inert wastes) of any other origin.

For the acceptance of commercial and industrial waste from the private sector, or contracted companies from municipalities, the interested parties must firstly enter into contract with the landfill site operator.

To enter into contract with the operator the waste carriers are required to obtain a solid non-hazardous waste disposal license.

For the issuance of this license the interested party has to provide the following documents:

1. A copy of operation license of the waste producer facilities, accompanied with a full description of the applied site processes (raw materials and products).
2. Approved copies of

* Environmental Impact Study of the company
* Approval of Environmental Permit Terms regarding operations and its waste production
* Waste Management Plan, as set by the Directive 96/61/EC

1. Solid waste classification based on national waste catalogues (which should preferably be harmonised with the European Waste Catalogue)and Description of waste content for disposal (i.e. data for the leachability, colour, odour and shape of waste for disposal).
2. Estimation of annual waste generation and transfer methods for solid waste
3. Declaration by the representative of the interested facility that: “*the transferred waste is not hazardous and belongs to the following categories under the national catalogue of wastes…”*

# Annex I: Marking of dangerous goods (examples)

**Europe standard hazard pictograms for labelling**

**Hazard pictogram Substance examples**

|  |  |
| --- | --- |
| [Hazard E.svg](https://en.wikipedia.org/wiki/File:Hazard_E.svg)*Explosive* (**E**) | TNT, acetone peroxide, nitroglycerin, picric acid |
| [Hazard FF.svg](https://en.wikipedia.org/wiki/File:Hazard_FF.svg)*Extremely Extremely Flammable* (**F+**) | hydrogen, acetylene, propane, butane, diethyl ether, carbon disulphide, ethanal |
| [Hazard F.svg](https://en.wikipedia.org/wiki/File:Hazard_F.svg)*Extremely Flammable* (**F**) | ethanol, acetone, gasoline, hexamine, methanol |
| [Hazard O.svg](https://en.wikipedia.org/wiki/File:Hazard_O.svg)*Oxidising* (**O**) | oxygen, potassium nitrate, hydrogen peroxide,nitric acid , potassium permanganate |
| [Hazard T.svg](https://en.wikipedia.org/wiki/File:Hazard_T.svg)*Toxic* (**T**) | sulfuric acid, TNT, nitroglycerin, carbon disulfide, methanol, ammonia, methanal |
| [Hazard TT.svg](https://en.wikipedia.org/wiki/File:Hazard_TT.svg)*Very toxic*(**T+**) | prussic acid, white phosphorus |
| [Hazard X.svg](https://en.wikipedia.org/wiki/File:Hazard_X.svg)*Harmful* (**Xn**) | hexamine, butane, ethanal |
| [Hazard Xi.svg](https://en.wikipedia.org/wiki/File:Hazard_Xi.svg)*Irritant* (**Xi**) | sodium hypochlorite, acetone, ethanol |
| [Hazard C.svg](https://en.wikipedia.org/wiki/File:Hazard_C.svg)*Corrosive* (**C**) | sulphuric acid, nitric acid, sodium hydroxide, ammonia, white phosphorus |
| [Hazard N.svg](https://en.wikipedia.org/wiki/File:Hazard_N.svg)*Dangerous for the environment* (**N**) | sulphuric acid, turpentine, lead, mercury |

*Gas under pressure* acetylene, anhydrous ammonia,

helium

*Health hazard* medical waste, coloured plastics

*Serious health hazard* PCBs, mercury, lead

# Useful links

Directive 91/156/EEC

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31991L0156&from=EN>

Directive 2008/98/EC (Waste Framework Directive)

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN>

Guidance document on Directive 2008/98/EC (Waste Framework Directive)

<http://ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf>

European Waste Catalogue

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32000D0532&from=en>

Hazardous waste consignment notes

<https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/300104/Consignment_note_LIT_6872.pdf>

Guidance on the classification and assessment of waste (UK)

<https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf>

Directive 1999/31/EC (Landfill Directive)

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999L0031&from=en>

WAC Decision

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003D0033&from=EN>

Waste Acceptance Criteria (WAC) and practices in South East Europe (mainly for non-hazardous wastes)

<http://www.enviroplan.gr/public/uploads/downloads/cowmngjmpw4d832cca2d43e.pdf>

WAC at landfills (UK)

<https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296422/geho1110btew-e-e.pdf>

1. All BREFs are available in English in <http://eippcb.jrc.ec.europa.eu/reference/> [↑](#footnote-ref-1)