

Technical Instructions on the Storage, Chemical, Physical and Biological Treatment, Incineration and Landfilling of Waste requiring Special Supervision

(TI Waste)

of 12 March 1991¹

Pursuant to Article 84 para. 2 of the Basic Law (*Grundgesetz*) and Article 4 para. 5 of the Waste Avoidance and Waste Management Act of 27 August 1986, the Federal Government, having heard the parties concerned, hereby adopts the following General Administrative Provision:

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¹ Technical Instructions on the Storage, Chemical, Physical and Biological Treatment, Incineration and Landfilling of Waste requiring Special Supervision of 10 April 1990, Joint Ministerial Gazette, p. 139, last amended on 23 May 1991, Joint Ministerial Gazette, p. 469, **repealed as of 16 July 2009 by administrative regulation of 27 April 2009**

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1 Scope

These Technical Instructions contain provisions for the recovery and disposal of waste requiring particular supervision in accordance with state-of-the-art technology and all relevant regulations required to safeguard the common good.

It shall apply in particular to:

- a) the drawing up of waste management plans (Art. 6 Waste Avoidance and Waste Management Act),
- b) decisions regarding applications for the plan approval or license for the setting up and operation of fixed waste management installations and any major alteration to such an installation or the operation thereof.(Art. 7 Waste Avoidance and Waste Management Act),
- c) authorisation of the premature commencement of the construction of waste management installations (Art. 7a Waste Avoidance and Waste Management Act),
- d) the acceptance, amendment and supplementation of instructions relating to requirements for waste management installations or the operation thereof pursuant to the outcome of the plan approval or following the granting of the license (Art. 8 para. 1 sentence 3 Waste Avoidance and Waste Management Act),
- e) the setting of time limits, conditions and instructions for fixed waste management installations that were in operation before 11 June 1972 or at which time the construction of which had begun, and the prohibition of their operation (Art. 9 Waste Avoidance and Waste Management Act),
- f) the assignment of waste to waste management sites (Arts. 8, 9, 10, 11 Ordinance on the Monitoring of Waste and other Residual Substances [*Abfall- und Reststoffüberwachungs-Verordnung*]),
- g) the setting of post-operational measures when a waste management installation is closed down (Art. 10 para 2 Waste Avoidance and Waste Management Act).
- h) the supervision of waste management and disposal, (Art. 11 Waste Avoidance and Waste Management Act),
- i) the licensing of the collection, transportation or delivery of waste materials (Arts. 12, 13 Waste Avoidance and Waste Management Act).

These Technical Instructions do not relate to the avoidance of waste, which is dealt with by Art. 1 a para. 1 of the Waste Avoidance and Waste Management Act. Waste avoidance is carried out pursuant to Art. 14 para. 1 nos. 3 and 4 of the Waste Avoidance and Waste Management Act. The obligation devolving upon operators of installations requiring a license to avoid waste in line with the requirements of the Federal Immission Control Act (*Bundes-Immissionsschutzgesetz, BImSchG*) by using low-waste procedures or by reusing/recycling residual materials derives from Art. 5 para. 1 no. 3 of the Federal Immission Control Act.

These Technical Instructions shall not apply to installations used exclusively or predominantly for the development and testing of new processes (test installations).

These Technical Instructions shall not apply to underground landfill in which waste is not or not fully enclosed in salt rock. The Federal Minister for the Environment, Nature Conservation and Nuclear Safety shall draw up further Technical Instructions in this respect.

Requirements relating to waste management based on provision other than those specifically relating to waste legislation shall remain unaffected.

2 General provisions

2.1 State-of-the-art

For the purposes of these Technical Instructions, the term state-of-the-art shall be understood to constitute the present level of development of modern processes, facilities or operational methods that demonstrate the practical suitability of a particular measure for environmentally sound waste management. To determine the state-of-the-art, comparable processes, facilities or operational methods shall be given particular attention where these have already been proved in practice.

2.2 Definitions and units of measurement

2.2.1 Definitions

Waste

For the purpose of these Technical Instructions, waste shall be understood to be waste as defined in the Ordinance on the Classification of Waste (*Abfallbestimmungs-Verordnung*).

Landfilling areas

For the purpose of these Technical Instructions, Landfilling areas shall be understood to be land-based or underground installation areas of a landfill in which waste may be deposited without limit of time.

Existing installations

For the purposes of these Technical Instructions, existing installations shall be understood as waste management facilities whose construction and operation is permitted at the time these Technical Instructions come into force.

Existing landfills

For the purpose of these Technical Instructions, existing landfills shall be understood as landfills whose construction and operation is permitted at the time these Technical Instructions come into force.

Working areas

For the purposes of these Technical Instructions, working areas shall be understood as areas within the operating site of the waste management installations in which waste materials are openly handled. The working areas may be located at the entrance, in storage areas or in the treatment area of a waste management installation.

Treatment plant

For the purposes of these Technical Instructions, a treatment plant shall be understood to be in a waste management installation in which waste is treated using chemical, physical and biological or thermal processes or combinations of these processes.

Treatment area

For the purposes of these Technical Instructions, a treatment area shall be understood to mean the area within the waste management installation which houses the facilities for treating waste.

Receptacles (*Behälter*)

For the purposes of these Technical Instructions, receptacles shall be understood to be fixed receptacles that are either open (e.g. bunkers) or closed (e.g. tanks).

Portable receptacles (*Behältnisse*)

For the purposes of these Technical Instructions, portable receptacles shall be understood to be either open or closed portable receptacles such as packaging drums, interchangeable containers, barrels or comparable containers including large transport boxes.

Landfill

For the purposes of these Technical Instructions, a landfill shall be understood to be a waste management installation in which waste can be landfilled without limit of time.

Entrance area

For the purposes of these Technical Instructions, an entrance area shall be understood to be an area within a waste management installation at which waste is delivered, sorted by weight or volume and identified.

Identity control

For the purposes of these Technical Instructions, an identity control shall be understood to be the examination of waste on delivery at a waste management installation. It shall consist of a visual inspection, an identifying analysis and sampling.

Storage area

For the purposes of these Technical Instructions, a storage area shall be understood to be that part of a waste management installation where waste materials, treatment chemicals or residual material are stored for a limited period.

Single-substance landfill

For the purposes of these Technical Instructions, a single substance landfill shall be understood as an aboveground or underground landfill or a particular part of a landfill in which waste originating from one defined production procedure, waste water procedure, or from the clean-up of contaminated sites or those of a comparable type and reaction behavior, may be landfilled without limit of time.

Underground landfill

For the purposes of these Technical Instructions, an underground landfill shall be understood to be a landfill in which waste is completely enclosed in salt rock.

Intermediate storage area

For the purposes of these Technical Instructions, an intermediate storage area shall be understood to be a fixed waste management installation in which waste is received, prepared for treatment, assembled for further management or stored.

2.2.2 Units of measurement and abbreviations

mg/kg	milligrams per kilogram (indication of concentration)
mg/l	milligrams per litre (indication of concentration)
μS/cm	micro Siemens per centimetre (conductivity)
kN/m ²	kilonewtons per square metre (compressive strength)
kJ/kg	kilojoules per kilogramme (energy content)
CPB	chemical, physical and biological treatment (<i>Chemisch/physikalische, biologische Behandlung</i>)
HMV	Municipal waste incineration plant (<i>Hausmüllverbrennungsanlage</i>) or other type of incineration installation not covered by these Technical Instructions
SAV	Incineration plant for waste requiring special supervision (<i>Sonderabfallverbrennungsanlage</i>)
HMD	Municipal waste landfill (<i>Hausmülldeponie</i>) or other landfill not covered by these Technical Instructions
SAD	Aboveground landfill for waste requiring special supervision (<i>Sonderabfalldeponie</i>)
UTD	Underground landfill (<i>Untertagedeponie</i>) in salt rock for waste requiring special supervision
MD	Single-substance landfill (<i>Monodeponie</i>)
TOC	Total organic carbon
AOX	Adsorbable organic halogenated compounds
UVPG	(<i>Umweltverträglichkeitsprüfungsgesetz</i>) Act on the Implementation of the Council Directive of 27 June 1985 on the Assessment of Certain Public and Private Projects on the Environment (85/337/EEC) of 12 February 1990 (Federal Law Gazette I, page 205)
VbF	(<i>Verordnung über brennbare Flüssigkeiten</i>) Ordinance on the Storage, Filling and Transportation of Combustible Liquids by Land of 27 February 1980 (Federal Law Gazette I, page 229) in the version of the First Amending Ordinance (<i>Erste Änderungsverordnung</i>) of 3 May 1982 (Federal Law Gazette I, page 569).

2.3 *Sampling, measuring and analysis*

Sampling and analysis, and the evaluation of the results of the measurements taken shall be carried out in line with the processes and provisions set out in Annex B.

2.4 *Exceptions*

The competent authority may permit deviations from the provisions of these Technical Instructions if in a particular case it can be proven that by means of the implementation of other measures the public good will not be damaged in respect of these Technical Instruction.

3 **Approval of waste management installations**

3.1 *General provisions*

A plan approval, a development consent or a decision on the early commencement of work in line with Arts. 7 and 7a of the Waste Disposal and Waste Management Act may only be issued if the criteria for the assignment of waste pursuant to no. 4 and the conditions to be met for the respective installation pursuant to nos. 6 to 10 have been satisfied.

The information normally required in applications for approval in the planning process or development consent for the erection and operation of fixed waste management installations or for any major modification to such installations or the operation thereof, are set out in Annex A.

3.2 *Financial guarantee*

Where the proprietor of a waste management installation pursuant to Art. 8 para. 2 of the Waste Disposal and Waste Management Act is obliged to (furnish) financial guarantee following the closure of the said installation in the interests of re-cultivation of the land or in order to remove impairment to the common good, this stipulation must as a rule be included as a condition in the permit for the installation. The financial guarantee may be subject to revision in the permit decision.

3.2.1 *Forms of financial guarantee*

The (furnishing of) financial guarantee may be demanded in the forms stipulated in Art. 232 of the Civil Code (*Bürgerliches Gesetzbuch*) and by other means of security suited to meeting the desired safety objective.

When determining the form of financial guarantee, particular attention shall be given to safeguarding the means of security against bankruptcy.

Financial guarantee shall include

- absolute bank guaranty of payment
- acquisition of real security (mortgage/encumbrance of real property)
- deposit of money set up as a reserve
- group security.

3.2.2 *Amount of financial guarantee*

The following aspects shall be taken into particular account when determining the amount of financial guarantee in the permit decision.

- a) the risk potential of the installation in line with its location, type and size taking into consideration the safety measures to be taken pursuant to these Technical Instruction and other provisions and the safety and long-term examinations to be undertaken.
- b) costs of measures to be taken following the closure of an installation, in particular for
 - concluding work (safety measures, retreat work)

- re cultivation
- post-operational measures
- c) possible subsequent changes to the financial guarantee based on the evaluation of monitoring results taken during operation.

3.2.3 Scaling and release of financial guarantee

- a) The financial guarantee may be paid in instalments, particularly in the case of waste landfilling installations.
- b) The financial guarantee shall be released where the objective of the security is met.

No. 3.2.3 a) shall apply accordingly.

4 Assignment of wastes to waste management options and facilities

4.1 Principle

Priority shall be given to the recovery of waste pursuant to the provisions of no. 4.3. The waste shall be pre-treated where this is required for recovery.

If recovery is not possible even after prior treatment, waste may be managed in other ways. In this case, the waste is to be treated where necessary in such a way, that its noxious and harmful components are eliminated, converted, segregated, concentrated or immobilised by thermal, chemical/physical or biological means pursuant to no. 8, so that, if they cannot be recycled/reused, they can be landfilled without any detrimental effects to the well-being of the public. Attempts shall be made to reduce the total volume of the waste.

4.2 Prohibition on mixing

The competent authorities shall ensure, within the framework of statutory waste supervision and statutory permits, that the composition of the waste materials and the concentration of toxic ingredients are not in any way influenced to circumvent the assignment of waste materials to disposal processes and installations pursuant to nos. 4.3 and 4.4.

Waste materials shall not, as a matter of principle, be mixed, even if they have the same waste code unless this is carried out in conjunction with the certificate of proof of disposal/recovery in line with the Ordinance on the Monitoring of Waste and Residual Materials (*Abfall- und Reststoffüberwachungsverordnung*), and on behalf of and on the instructions of the operator of the proposed waste management installation or of the party responsible for recovery.

4.3 Recovery

4.3.1 General provisions

The recovery of waste shall take precedence over other forms of waste management if:

- a) this is technically feasible
- b) the additional costs thereby incurred are not disproportionate to those of other management processes and
- c) a market exists for the resultant substances or energy, or if such can be created in particular by the involvement of third parties.

4.3.2 Recovery options

The authority responsible for the waste generator in question shall ensure that the waste generator satisfies his obligation to recycle/reuse waste in substance or energy form. This may take place

- a) within the operating premises of the waste generator,
- b) in the operating premises of other operations or
- c) outwith the installations pursuant to a) or b), for example during road-building work.

The conditions pursuant to nos. 4.3.3 and 4.3.5 shall be met. The competent authority shall, in this regard, examine whether the proposed method of recovery has an overall more detrimental effect on the environment than other waste management procedures.

4.3.3 Technical feasibility

Recovery shall be deemed technically feasible if a suitable procedure is available. In this respect, all possible recycling techniques shall be taken into consideration. The recovery of waste shall also be considered technically feasible if the only processes available are those requiring pre-treatment of the waste. In such cases, the recovery must also include the implementation of treatment measures.

4.3.4 Reasonableness

The recovery of waste shall be considered reasonable if carried out by other comparable parties responsible for waste management. When determining reasonableness, account shall be taken of whether

- the recovery is generally more beneficial to the environment than other waste management processes,
- costs may be reduced by jointly treating the waste of several waste generators.

4.3.5 The existence and the creation of a market

A market shall be regarded as available for the recovered substances or energy if the sale thereof seems to be assured both now and in the near future. A market may be created in particular by involving third parties if this enables the waste of several waste generators to be jointly recycled/reused.

4.3.6 Notification of other authorities

Where, while examining the disposal certificate, the authority responsible for the waste management installation becomes aware of the possibility of recycling/reusing a certain type of waste, the said authority shall inform the authority responsible for the waste generator of this. In cases where the waste originates from an installation subject to licencing under the Federal Immission Control Act (*Bundes-Immissionsschutzgesetz*), a similar notification must be made to the authority responsible for monitoring compliance of Art. 5 para: 1 no. 3 of the said Act.

4.4 *Criteria for allocating waste to another form of management*

4.4.1 General provisions

In cases where it can be proven that waste cannot be recycled/reused, the said waste shall be allocated to an installation for treatment or storage, guidance for which can be found in the catalogue of waste requiring special supervision contained in Annex C.

The final assignment of a waste material to a particular waste management installation shall be entered in the disposal certificate and shall be based in particular based on the particular characteristics of the waste product in question and on the permit for the waste management installation. An assessment of the characteristics of the waste material shall include information on the following parameters:

- consistency

- appearance, colour
- odour
- incineration properties under normal conditions
- reactions with water and other substances

as contained in no. 4 of the disposal certificate together with the details contained in Annexes 1a to 1f of the said certificate.

In individual cases, it may be that the waste can be disposed of in an environmentally sound way, in a waste management installation to which these Technical Instructions do not apply. These installations shall be marked with the letters HMV and HMD as set out by way of example in Annex C.

The disposal/collection disposal certificate requires that the following steps be taken

1. By the waste generator (by the transporter in the cases of collective disposal):
 - a) Details of the waste-code with the disposal certificate pursuant to the catalogue of wastes requiring particular supervision.
 - b) Description of the waste and choice of the waste management installation in the liability declaration of the disposal certificate taking into account the criteria pursuant to nos. 4.4.2 and 4.4.3. In this regard, the relevant form containing the declared analysis (Annexes 1 a – 1 f) of the disposal certificate shall be completed.
 - c) Inquiry made of the operator of a waste management installation, including the liability declaration as to whether the installation in question has been approved for the declared waste and whether the operator is prepared to accept this waste.
2. By the operator of a waste management installation:
 - a) Verification of the plausibility of the liability declaration; comparison with the installation permit; verification as to whether sufficient capacity is available.
 - b) Once the disposal facility has been confirmed, forwarding of the liability declaration and the declaration of acceptance to the authority responsible for the waste management installation.
3. By the authority responsible for the waste management installation:
 - a) Verification of the plausibility of the liability declaration; inspection of the declaration of acceptance; check on whether the declared waste can be disposed of in the manner indicated in the permit; where appropriate confirmation of the proposed method of disposal.
 - b) Forwarding of the disposal certificate to the operator of the waste management installation.

The waste generator shall only arrange for the declared waste to be passed on to a carrier for transportation to the Waste management installation after the confirmation of disposal has been issued.

4.4.2 Assignment criteria for treatment

4.4.2.1 Chemical, physical and biological treatment

Wherever possible, a waste material shall be passed for chemical, physical or biological treatment if it contains unacceptable quantities of environmentally harmful substances or compounds, which can be separated, converted or immobilised and thus rendered less harmful. For the chemical, physical or biological treatment, the parameters listed in Annex 1a of the disposal certificate are relevant in conjunction with the requirements contained in no. 4.4.1.

4.4.2.2 Incineration

Wherever possible, a waste material shall be passed for incineration if it contains organic substances in accordance with no. 4.4.3.1 para 4 which can be destroyed by heat in accordance with the state-of-the-art technology, or alternatively if it contains any other organic substances in such quantities that are

harmful to the environment. For the incineration process, the parameters listed in Annex 1b of the disposal certificate and the guaranteed combustibility of the waste material (calorific value in excess of 7,000 kJ/kg) are relevant in conjunction with the requirements contained in no. 4.4.1.

4.4.3 Assignment criteria for landfilling

4.4.3.1 Ground-level landfilling

Waste may be allocated to ground-level landfilling if, with due regard to the provisions pursuant to no. 4.4.1, the assignment parameters set out in Annex D are met. If the waste is not adequately solid (assignment parameter D1 in Annex D), solidification measures shall be permitted in order to comply with the assignment value.

Apart from the requirements pursuant to Nr. 4.4.1 and the assignment parameter from Annex D, the following criteria shall be observed:

- a) Wastes may only be landfilled at ground level if they do not give off offensive odours to the surrounding neighbourhood.
- b) Waste, which because of its origin or constitution described in the disposal certificate, are likely to damage the common good during their storage in view of its toxic, long-life or bioaccumulating substances (e.g. organic halogenated compounds, organic phosphorous compounds) shall not, as a matter of principle, be allocated to ground-level landfilling.
- c) If the assignment parameter D2 contained in Annex D is exceeded (loss of ignition of the dry residue of the original substance), ground-level landfilling may be permitted if, in conjunction with the details of nos. 1 – 7, it can be shown that, under landfilling conditions the waste does not lead to any reactions that could cause hazardous substances to be released in great quantities, or, that the fact that the parameter is exceeded cannot be attributed to its content of organic carbon.

Waste which does not meet the assignment criteria D1, D3, D4.08, D4.16; D4.18, D4.19 or D4.20 as contained in Annex D are to be allocated to chemical, physical or biological treatment. Alternatively, consideration shall be given to assignment to underground landfilling for waste, which does not meet the assignment criteria D4.08, D4.16, D4.18 and D4.20 in Annex D.

Waste, which exceeds the assignment parameters D2 (if it is organic carbon), D3, D4.04 or D4.19 from Annex D, or waste mentioned in para. 2 b) shall be allocated to incineration.

4.4.3.2 Underground landfilling

Waste may be allocated to underground dumping sites if it contains no pathogenes of communicable diseases or can allow such pathogens to arise and if, depending on the type of installation and the specific landfilling conditions, it is adequately stable for landfilling or reaches this stability in the final stage.

The following may not be allocated to an underground landfill:

- a) waste which, under landfilling conditions (temperature, humidity), are self-igniting, or self-combustible and waste which is explosive.
- b) Waste which, under landfilling conditions and because of reactions among the waste material or with the salt rock lead to
 - increases in volume
 - the formation of self-igniting, toxic or explosive substances or gases or
 - other hazardous reactions,

if operational safety and the integrity of the barriers is thereby called into question.

Moreover, the following may not be landfilled in passable underground openings:

- a) waste with a pungent odour

- b) waste, which, under landfilling conditions, forms gas-air mixtures, which are toxic or explosive. This shall also include in particular waste which
 - because of the partial pressure of its constituent substances causes toxic concentrations of gas,
 - at the saturation stage in closed containers form concentrations that are higher than one power of ten below flammability level.

3.3.3 Single-substance landfilling

Single-substance landfilling may be carried out above or below ground. As a matter of principle, the requirements pursuant to nos. 4.4.3.1 and 4.4.3.2 shall apply.

Waste both the type and amount of whose drainage water can be estimated may only be allocated to a ground-level single-substance landfill if the individual assignment parameters in Annex D with the exception of D1 are exceeded. In cases such as these, proof shall be furnished that ground-level single-substance landfilling will not have a more damaging effect on the environment than landfilling pursuant to the requirements of no. 4.4.3.1. Exceptions to this shall be waste pursuant to no. 4.4.3.1 para. 2 b).

5 Requirements to be satisfied by the Organisation and the Personnel of Waste management facilities and also by systems of Information and Documentation

5.1 Structural organisation

5.1.1 General

Waste management facilities shall have at least one "Control Department" which is separately run and separately staffed from any other organisational departments.

This "Control Department" shall be responsible for preparing the acceptance declaration in the disposal certificate in accordance with section 5.2.2, the acceptance control in accordance with section 5.2.3, the outwards control in accordance with section 5.2.5 and all other controls contained in nos. 6, 7, 8, 9 and 10.

The structural organisation of the waste disposal installation shall be represented in an organisational plan, which shall define the duties of the respective organisational departments. All heads of department and their deputies shall be identified. This organisational plan shall be understood to be part of the organisational handbook in accordance with section 5.4.2. It must be available for inspection by the competent authority if the latter so requests.

5.1.2 Special regulations

5.1.2.1 A number of waste management facilities at one site

In cases where a number of waste management facilities or parts thereof are located at one site, the duties of the corresponding organisational departments may be carried out on a communal basis.

5.1.2.2 A number of waste management facilities located at different sites

Where a company operates a number of waste management facilities at different sites, certain duties that do not require constant attendance at the site (for example, the preparation of the acceptance declaration for the disposal certificate and the arrangements for the disposal of the waste material) may be carried out on a communal basis.

5.1.2.3 Exceptions for certain waste management facilities

The competent authority may grant exceptions to the requirements set out in section 5.1.1 for waste management facilities that:

- a) are approved for less than ten different types of waste (waste-codes), and
- b) store or treat annually less than 5,000 tonnes of this waste, and
- c) have less than six employees, or
- d) which are geographically and operationally closely linked with a Production plant.

5.2 *Procedural organisation*

5.2.1 General provisions

During the course of the disposal of waste materials, the operational duties indicated under nos. 5.2.2 to 5.2.5 shall be carried out.

Departures may be made from the requirements set out in nos. 5.2.3, 5.2.4 and 5.2.5 if the waste disposal installation is geographically and functionally a part of other installations that have been approved under the Waste Avoidance and Waste Management Act or the Federal Immission Control Act and where these satisfy the above duties in an equivalent manner.

5.2.2 Preparing the acceptance declaration in the disposal certificate

The operator of the waste disposal installation is required to carry out the following duties in connection with his preparation of the acceptance declaration:

- a) consulting with the generator of the waste material for the preparation of the formal declaration. He is also required to carry out any declaration analysis that may be needed for and on the account of the generator of waste material,
- b) carrying out all investigations required for the completion of the acceptance declaration,
- c) testing the formal declaration with regard to the effective operation of his disposal installation,
- d) determining the nature, extent and frequency of identity controls,
- e) determining delivery conditions and safety regulations for handling waste materials,
- f) completing the acceptance declaration,
- g) sending the disposal certificate to the authority responsible for the waste disposal installation.

The duties defined in a) and b) above may be carried out by a suitable third party on the instructions of the operator.

5.2.3 Acceptance control

An acceptance control shall be carried out whenever waste materials are delivered to the waste management facilities. This shall include:

- a) an inspection of the dispatch documents,
- b) a comparison of the details in the dispatch documents with those in the disposal certificate,
- c) calculation of the weight of the consignment. If it is not practicable for units of weight to be used, the calculation should be expressed in units of volume;
- d) identity control: Samples shall be taken and kept at least until the end of the normal treatment of each respective delivery of waste material. In the case of ground-level and underground landfill, the retention period shall be determined in the light of the sample, in particular in relation to the frequency of official monitoring, but, for ground-level landfill shall be at least one month; in the case of underground landfill, the retention period shall continue until either the subcritical area of the mine or the cavern has been sealed. An identity analysis and sampling may be dispensed with in certain justified circumstances. In these cases, the grounds for this shall be recorded,
- e) comparison of the results of the identity control with the details contained in the formal declaration of the disposal certificate. The terms of no. 3.2 in Annex B shall be observed.

If the results of the identity control match the details of the formal declaration, the consignment of waste material shall be accepted.

If the results of the identity control do not match the details of the formal declaration, the circumstances shall be clarified with the person responsible for signing the formal declaration. If the waste disposal installation is authorised to dispose of the consignment of waste in question, the consignment may be accepted. The process is to be documented in accordance with no. 5.4.3.

- f) Issue of an internal memorandum documenting the results of the acceptance control and of the assignment to the place of delivery, together with the required treatment measures. In addition, in the case of treatment plants, the necessary treatment plants and in the case of landfill the place of landfilling shall be documented.
- g) If a waste disposal installation is not authorised to dispose of the waste material in question, the authority responsible for the waste disposal installation shall decide on how best to proceed based on the information provided by the operator of the plant. In the meantime, the waste material shall be stored safely in a specifically approved area of the plant until the authority has reached its decision.

5.2.4 Documentation for the delivery process

The delivery of the waste material is to be documented in the internal memorandum.

5.2.5 Exit control

Before the departure of the delivery vehicle, the internal memorandum shall be verified and retained.

5.3 *Personnel*

5.3.1 General provisions

The operator of the waste disposal installation must have at all times sufficient personnel with the requisite qualifications. All personnel shall undergo specific job training and further education.

5.3.2 Supervisory personnel

The supervisory personnel and all heads of sections in the waste management facilities in accordance with section 5.1 shall be reliable and technically qualified and they must have appropriate practical experience.

Technical qualifications must have been obtained from a successfully completed course at a state or stage recognised institute of further education, technical college or engineering school.

Technical expertise will also be recognised based on comparable training or a prolonged period of practical experience.

5.3.3 Other personnel

Other personnel must be reliable and technically skilled. This technical skill may be based for example on formal qualifications in such areas as community services and waste disposal, or many years of practical experience or on comparable training.

5.4 *Information and documentation*

5.4.1 Site regulations

The operator of a waste disposal site must compile a schedule of site regulations before the installations commence operation. These regulations shall be updated as necessary.

The site regulations shall contain all regulations relating to operational safety and order. They shall be made available to the competent authority.

5.4.2 Site handbook

The operator of a waste disposal site must also compile a site handbook before the installations commence operation. This site handbook shall be updated as necessary.

The site handbook shall contain all regulations governing the normal operation, maintenance and repairs needed to ensure the proper and safe disposal of waste material. All processes shall be harmonised with alarm and emergency procedures.

The site handbook is also to detail the duties and the responsibilities of the personnel in accordance with section 5.3, working instructions, control and maintenance procedures together with details of all information, documentation and maintenance obligations as set out in nos. 5.4.3 and 5.4.4.

5.4.3 Site daybook

5.4.3.1 Contents of the site daybook

The operator of a waste disposal installation shall keep a site daybook as evidence of the proper running of the establishment.

The site daybook shall contain all relevant information for the day-to-day running of the waste disposal installation, and in particular:

- a) records of disposal of all waste material in the site and of any other residues that are recycled outside the site or disposed of in some other manner,
- b) records of deliveries of waste material,
- c) records of any residues recycled or disposed of by some other manner outside the site,
- d) all documentary evidence in case the delivery of waste material does not correspond to the details contained in the formal declaration of the disposal certificate, and details of all measures taken,
- e) all incidents, and in particular details of any working interruptions, including details of the possible causes and the remedies adopted,
- f) all working times and downtimes of the installation,
- g) results of internal investigations and measurements,
- h) The nature and scope of maintenance measures,
- i) Results of functional tests.

All additional supporting statements required by the competent authorities shall also be documented in the site daybook.

5.4.3.2 Keeping the site daybook

The site daybook shall be signed on a weekly basis at least by the head of the "Control Department". The site daybook may be organised in the form of collection of loose sheets by persons from the different areas of the site in accordance with no. 6.1.1 if these sheets are prepared on a daily basis. The site daybook may be run on a computer. It shall be compiled in such a way that there is no risk to the supporting documents and that it is protected from unauthorised access.

5.4.3.3 Safekeeping

The site daybook shall be kept for a period of 5 years, in the case of landfill 5 years after the closure of the installation, and produced for inspection as required by the competent authority.

In the case of ground-level landfill, the annual survey pursuant to no. 5.4.4.2 and the files containing the certification of disposal shall be kept at least until the end of the post-operational phase pursuant to no. 9.7.2.

5.4.4 Liability of disclosure to the authority

5.4.4.1 Reporting of incidents

Any incidents leading to a major departure from the normal system of operation – in particular, those bringing the plant to a standstill – shall be reported immediately to the competent authority.

Any other disclosure obligations deriving from national or state legislation shall remain unaffected.

5.4.4.2 Annual survey

The operator of the waste disposal plant is required to submit an annual survey containing the details referred to in no. 5.4.3.1. b), c), e) and f). All references to b) and c) are to use the waste codes contained in Annex C. The information under b) is also to be broken down into waste generators. Additionally, the information in no. 5.4.3.1, letters e) and f), and for ground level and underground landfill letter g) is to be evaluated and commented on.

The annual survey must also contain a quarterly balance of waste and residue consignments, including auxiliary materials used, for each site, broken down into categories of CPB, SAV, SAD, UTD and MD.

The annual survey shall be submitted to the competent authority in the three-month period following the end of the year.

6 Overlapping requirements for intermediate storage areas and installations for the treatment of waste

6.1 General provisions

6.1.1 Site areas

Intermediate landfilling areas pursuant to no. 7, treatment plants pursuant to no. 8, ground-level landfill pursuant to no. 9 and underground landfill pursuant to no. 10 shall consist of at least: a delivery area, a storage area and a working area.

In the case of treatment plants, a further treatment area and in the case of ground level and underground landfill a storage area shall be set up, in each case separated from the other areas.

The following items are to be provided for the delivery area, the storage area and the working area:

- a) materials and equipment for fire-fighting purposes and mountings for fire extinguishers,
- b) cleaning equipment and a system for flushing out ducts, receptacles and containers,
- c) sufficient quantities of absorbant material to absorb or collect any spilled or leaking waste.

The above substances and equipment may be stored centrally, if the site area in question and the area in which the items are stored are adjacently located.

6.1.2 Marking systems

In the planning and working documents for waste treatment installations pursuant to no. 8, for ground-level landfill pursuant to no. 9 and underground landfill pursuant to no. 10, a standardised marking system shall be used for the individual systems, components and structural sections. This system shall also be used for marking the installations.

6.1.3 Water supplies

The terms of DIN 1988 shall be observed.

6.1.4 Piping

All pipes used for the transportation of waste materials or substances that are harmful to water are to be arranged above ground level in such a way that any leaks can be instantly detected and easily repaired. The ground below the pipes must not be able to be contaminated by substances leaking from the pipes. All pipe joins are to be tested for impermeability at regular intervals.

6.1.5 Watertight seals

All storage areas, working areas and treatment areas, together with all areas in which contaminated water can occur, shall be tightly sealed in such a way that there is no risk of the subsoil becoming contaminated. These areas shall be tested for water-tightness at regular intervals.

6.1.6 Roofing

All working areas and storage areas for receptacles and for open containers shall be provided with roofing.

6.1.7 Drainage water collection and disposal

All working areas and other areas, in which contaminated water can collect, for example washing areas for tanker vehicles and containers, shall be provided with a separate system of drainage water collection (insular draining).

Drainage water from such insular drained areas, together with washing and spraying water, shall be regarded as liquid waste and disposed of accordingly.

Any other drainage water may only be disposed of if officially determined threshold values are observed.

If drainage water is introduced into standing water, the requirements of para. 7a of the Federal Water Act (*Wasserhaushaltsgesetz*) shall be observed.

6.1.8 Exceptions

The provisions of nos. 6.1.4 to 6.1.7 shall not apply to the storage areas of waste landfill.

6.2 *Requirements for deliveries of waste materials*

6.2.1 General provisions

Deliveries of solid, semi-solid, sludgy and liquid waste material shall be subject at all times to conditions tailored specifically to the conditions of the installation in question.

Insofar as waste materials are delivered in receptacles, these latter should be of the returnable type. If waste materials are delivered in non-returnable containers, this latter should for preference be of the combustible type.

Each container or receptacle should be clearly marked before delivery, so that the contents and the origin can be clearly identified at all times.

Delivery shall take place in such a way that the handover can take place directly in the storage area or that direct incineration or storage is possible. Waste which is to be stored or landfilled underground and which is delivered in containers which do not meet the standards set out above, which are damaged or which are otherwise unsuitable, shall be transferred or put into containers (Behälter/Behältnisse) which

are suitable. In the case of aboveground landfill, waste in damaged containers shall only be landfilled directly if hazardous substances are not released when the containers are inserted into the landfill.

Acceptance of waste in aboveground landfill pursuant to number 9 shall take place via interim facilities. These shall be designed in such a way that delivery traffic is separated from landfilling traffic.

Empty non-returnable containers are to be incinerated immediately or cleaned before being re-used or recycled.

6.2.2 Requirements for waste materials that are specific to hospitals

In addition to the requirements contained in no. 6.2.1, waste materials that are specific to hospitals shall be delivered in containers that are designed based on the subsequent disposal method. Waste materials with the waste code 971 04 shall be delivered in combustible type-approved non-returnable containers. Waste materials with the waste code 970 01 shall be delivered either in combustible, type-approved non-returnable containers or in non-returnable containers in type-approved interchangeable containers. Any unauthorised opening of these containers or transfer of their contents, or grading of the waste material shall be prohibited.

6.3 Storage areas

6.3.1 Delivery area

The delivery area must comprise at least:

- a) a parking area for delivery vehicles,
- b) a weighbridge with a deliveries office,
- c) a laboratory,
- d) a sampling point with a separate drainage water collection point (insular drainage), and
- e) storage facility for samples,

unless it can be shown that these facilities are geographically and functionally closely located, or that they can be dispensed with altogether (e.g. if waste is delivered through a pipeline).

6.3.2 Working area

Sampling points in the delivery area shall be deemed working areas. Working areas shall be equipped with appliances for opening, refilling, emptying and cleaning containers and receptacles.

Working areas shall be marked as such.

In cases where containers may pose risks when being opened or when their contents are being handled, a safety area shall be established. This safety area shall be located within a working area. It should be designed in such a way that, in the event of a breakdown, the adjoining site areas are not affected.

Similarly, the creation of working and safety areas may be dispensed with if it can be shown that these areas are geographically and functionally closely related to other disposal or production plants.

6.3.3 Storage area

6.3.3.1 General provisions

Waste materials shall be stored away from auxiliary materials. Separate and marked storage areas shall be provided for receptacles and containers.

Separate storage is to be ensured by means of adequate distances between the stored items, unless the nature and the characteristics of the waste materials require additional technical measures. The contents of each individual container must not be able to leak out and find their way into adjacent storage areas.

The transfer of waste materials into the storage area must be carried out in accordance with the requirements contained in nos. 6.3.3.1.1 to 6.3.3.1.5.

6.3.3.1.1 Intermediate storage

Storage capacities of intermediate storage areas must be geared to the storage and throughput capacities of the proposed disposal installations.

Separate and clearly marked storage areas are to be provided for waste materials allocated for disposal, chemical, physical or biological treatment or for incineration.

6.3.3.1.2 Chemical and physical treatment plants

Open preliminary storage facilities shall be provided for waste materials in liquid form that have been allocated for chemical or physical treatment. Closed containers are to be used for volatile halogenated hydrocarbons and liquids with a flash point. These preliminary storage containers are subject to the requirements contained in no. 6.3.3.3.

In-chemical and physical treatment plants, the following groups of waste materials shall in each case require separate delivery installations and separate and marked storage areas:

- Organic waste materials
 - a) waste materials with halogenated organic solvents,
 - b) waste containing nitrites,
 - c) waste containing cyanide,
 - d) other organic waste.

For the organic materials, each preliminary container is to be fitted with a separator for solid, easily separated substances and a device for skimming off the free oil content.

- Inorganic waste materials
 - e) alkaline waste materials
 - f) waste containing nitric acid,
 - g) other acid wastes,
 - h) waste containing cyanide,
 - i) waste containing nitrites,
 - k) waste containing chromates,
 - l) waste containing complex-forming substances.

6.3.3.1.3 Incineration plants

In incineration plants, separate and marked storage areas are to be established for the following groups of waste materials:

- a) solid waste,
- b) semi-solid waste,
- c) liquid or sludgy wastes, free of halogenated organic compounds,
- d) liquid or sludgy wastes, containing halogenated organic compounds,
- e) waste materials in receptacles.

Determination of consistency shall take place in line with the German Institute for Standardisation, reference number DIN-ISO 2137-1981.

6.3.3.1.4 Ground-level landfill

Ground-level landfill where waste is landfilled separately, separate and marked storage areas shall be set up. At least one storage area shall be set up in any case unless the waste can be stored in moveable sites such as in road vehicles, train carriages or other suitable means of transport. There shall be a fixed-length storage time.

6.3.3.1.5 Underground landfill

The capacities of storage area shall be measured in such a way that they are at least in a position to accept the daily delivery load, unless the waste can be stored in moveable sites such as road vehicles, rail carriages or other suitable means of transport. There shall be a fixed-length storage time.

6.3.3.2 Requirements for the storage of waste materials specific to hospitals

The following conditions shall be met over and above those pursuant to no. 6.3.3.1.

Cooled storage rooms shall be provided for waste specific to hospitals (waste code 971 01 and 971 04) (highest room temperature + 10°C) which are to be stored for longer than 48 hours in the waste management installation. The total duration of storage is determined by the temperatures in the storage rooms and the time at which the waste materials were packed by the waste generator. The working and storage areas of the storage rooms are to be designed in such a manner that the Ministry of Health recognised disinfectant materials and methods can be used at all times.

When using returnable containers for conveying non-returnable containers, appropriate cleaning and disinfecting equipment shall be provided.

All waste from storage and disinfectant processes is to be collected and treated.

6.3.3.3 Storage in containers

Insofar as waste materials are not delivered and stored in containers, solid and semi-solid waste shall be stored in multiple cassette bunkers, sludgy waste in multiple cassette bunkers or in tanks above ground level and liquid waste in tanks above ground level.

All containers must be designed in such a manner that they are corrosion resistant to the waste to be stored in them, so that no contamination can take place in the ground immediately beneath, or in the adjacent areas. Furthermore, they are to be constructed in such a manner that they can be tested, for example, in a double walled construction with a leakage indicator, or so that it is possible to walk underneath them, and so that they can be repaired from the inside. If tanks are used, the same effect may be obtained using collector trays.

The type, size, number and arrangement of the containers are to be selected in such a way that the requirements contained in nos. 6.3.3.1.1, 6.3.3.1.2, 6.3.3.1.3, 6.3.3.1.4 or 6.3.3.1.5 are satisfied. The tanks are to be clearly marked with the nature of their contents.

The filling devices for the tanks shall be fitted with coarse separators for the separation of solid impurities. The tanks are to be fitted with the following control and safety equipment:

- a) level indicators,
- b) lockable access and inspection parts,
- c) temperature gauge,
- d) overflow and pressure safeguards with alarm devices,
- e) lightning conductor systems,
- f) ventilation and seration systems,
- g) pressure gauge,
- h) filler system with automatic filling cut-off.

The tanks shall be set up in collector trays and spaced out at appropriate distances. The size of the collector trays is to be such that the contents of the largest tank standing in them, but not less than 10 per cent of the contents of all tanks arranged in a single collector tray, would fit into the tray. All single-walled tanks to be used for the individual storage of waste in accordance with no. 6.3.3.1.2 shall be arranged in separate collector trays.

In the case of double-walled tanks, all apertures shall be above the possible liquid level.

7 Special requirements for intermediate storage installations

7.1 General provisions

Intermediate storage installations are to be operated in such a way that subsequent recycling, thermal, chemical, physical or biological treatment or the subsequent storage of the waste material shall not be impaired, or the waste material is not modified within the sense of no. 4.2.

Waste materials can only be accepted for intermediate storage if a disposal certificate for eventual disposal accompanies them.

7.2 Distinguishing features

Intermediate storage installations may be subdivided as follows based on their individual functions:

7.2.1 Installations used in conjunction with equipment for preparatory treatment,

7.2.2 Installations used exclusively as a storage facility prior to final disposal, and

7.2.3 Installations, in which larger units are assembled for subsequent disposal.

7.3 Preparatory treatment

In the case of intermediate storage establishments in which waste materials are treated chemically, physically, biologically or thermally prior to subsequent dispatch or disposal, the requirements contained in no. 8 shall apply accordingly.

7.4 Storage and water extraction

In the case of intermediate waste management facilities in which waste materials are to be exclusively stored, or on the stipulation of the disposer, have their water content extracted, the requirements contained in nos. 6.3.3.1.2, 6.3.3.1.3 and 8 shall not apply.

7.5 Collection into larger units

In the case of intermediate storage installations, in which waste materials are exclusively stored and collected into larger units for eventual disposal, the requirements contained in nos. 5.2.2, 5.2.3, 6.3.3.1.2 to 6.3.3.1.5 and 6.3.3.3 shall not apply.

All waste materials are to be delivered in receptacles unless other arrangements have been made for the delivery of bulk or liquid waste.

The delivery containers may only be opened for sampling, for preparatory treatment, for collection into larger units for ultimate disposal or if they are damaged.

Insofar as such intermediate storage installations are geographically or functionally in close proximity to a production plant, delivery in receptacles may be dispensed with. The requirements in accordance with nos. 5.4.3, 5.4.4.2, 6.1.1 and 6.2 apply accordingly.

7.6 *The Storage of small quantities*

In cases where intermediate storage installations receive deliveries of waste falling under para. 1 (2) of the Waste Avoidance and Waste Management Act, the terms of Nos. 5.2, 5.4.2, 5.4.3, 5.4.4.2, 6.1.2, 6.2.2, 6.3.1, 6.3.3.1.2 to 6.3.3.1.5 and 6.3.3.2 shall not apply. The terms of no. 6.1.1 shall apply accordingly. The classification of the waste materials must be carried out by the operator of the waste disposal installation in question using qualified personnel in accordance with no. 5.3. The operator of the intermediate storage installation is required to keep a site daybook that diverges from the conditions stipulated in no. 5.4.3. It must contain as a minimum:

- a) all documents relating to deliveries of waste,
- b) disposal certificates for deliveries of waste and residues,
- c) details of any unusual incidents, in particular, any operational stoppages, including possible reasons for this and any remedial steps taken,

In the same way, the operator shall be required to compile an annual survey diverging from the conditions stipulated in no. 5.4.4.2. This shall contain as a minimum details of the types and quantities of the waste materials received together with storage time data. He shall be required to submit this to the competent authority within three months of the end of each calendar year.

8 **Special requirements for treatment installations**

8.1 *Principle*

All thermal, chemical, physical or biological treatment of waste materials shall be carried out in such a way that the resultant residues can be recycled in accordance with the terms of no. 4.4.3, 4.4.3.1 or 4.4.3.3, and that only very small quantities of waste materials with a toxic concentration are left to be disposed of in accordance with the terms of no. 4.4.4.3.2.

If necessary, a number of treatment processes shall be carried out.

When waste materials are incinerated, an oxidative process shall be used to reduce the toxic potential of the waste, to reduce the quantity and the volume of the waste material and to recover any usable energy.

8.2 *General-principles*

A delivery of waste may only be accepted if a disposal certificate is submitted for the residues accruing after processing.

A separate area shall be created within treatment plants and this is to be kept free for waste material arising from accidents during transportation or from operational breakdowns and for the safekeeping of waste delivered with a false declaration. The area is to be laid out in such a way and so equipped that it can accommodate a minimum of 30 cubic metres of waste of as many different types as possible.

All treatment plants shall have an adequate standby power system.

8.3 *Chemical and physical treatment plants*

8.3.1 Technical requirements

8.3.1.1 General principles

Separate treatment lines are to be provided for the treatment of waste material that is predominantly inorganic and waste that is predominantly organic.

The reactors in which the chemical and physical processes take place shall in principle be of the closed construction type. Two armatures in sequence shall be fitted into the inlet piping of the reactor vessels.

All containers and reactors are to be fitted with level indicators with a monitoring system and temperature control devices. Reactors for inorganic treatment shall also be fitted with devices for measuring the pH and the redox potential. In addition, all containers are to be equipped with a pressure monitoring system.

All divergences from threshold values shall be indicated by both visual and acoustic alarm systems.

All material losses, the pH value and any discolouration of the wastewater must be continuously monitored. If a threshold value is exceeded, the process shall be brought to an automatic halt.

8.3.1.2 Organic treatment plant

Processes used in the organic treatment plant may include emulsion separation processes such as distillation, chemical emulsion separation and membrane filtration.

Distillation plants should be equipped essentially for the following functions:

- a) the separation of solids
- b) distillation
- c) oil extraction from residues, and
- d) neutralisation.

Chemical emulsion separation plants should be equipped essentially for the following functions:

- a) the segregation of sedimentable solids
- b) the segregation of floating impurities
- c) the metering of process chemicals
- d) chemical emulsion separation, and
- e) the separation of reaction products.

Membrane filtration plants should be equipped essentially for the following functions:

- a) the segregation of sedimentable solids
- b) the segregation of floating impurities
- c) fine filtration, and
- d) membrane filtration.

The above emulsion separation processes may be followed by further treatment stage, such as stripping, active carbon adsorption or biological treatment.

Mixtures of water with oil containing chlorinated hydrocarbons: cyanide and nitrites shall be subjected to separate pre-treatment before they are processed together with other oil/water mixtures.

In addition to the emulsion separation processes described above, there are other processes that can be used for treating emulsions or organically contaminated aqueous wastes based on, for example, adsorption, absorption, extraction or thermal fissure, accompanied by appropriate preliminary and subsequent operations.

8.3.1.3 Inorganic treatment plant

In the inorganic treatment plant, processes such as neutralisation, precipitation, flocculation, oxidation, reduction and dewatering can be used, the choice or combination of which is determined by the waste being processed. These processes can be arranged in such a way that the individual plant components can operate either mono-functionally (separate fixed treatment plants) or multi-functionally (an optional combination of different plant components).

The inorganic treatment plant should be equipped essentially for the following functions:

- a) segregation of floating impurities,
- b) the metering of process chemicals,

- c) the initiation of chemical reactions, and
- d) sludge conditioning and dewatering.

The above processes can be followed by other treatment stages, such as active carbon adsorption or stripping.

Heavy metals are in principle to be precipitated in the form of hydroxides or oxyhydrates by selecting an appropriate pH value.

Furthermore, additional treatment processes such as a further sulphide precipitation, ion exchange or reverse osmosis may be needed.

8.3.2 Operational requirements

Before a charge is treated, the treatment conditions must be determined based on laboratory or works tests. The type and quantity of chemicals to be used must be calculated and documented in a treatment plan.

Waste materials may be used for reciprocal treatment processes unless this would result in a disadvantage for the treatment process or to a dilution of the material.

Whenever a charge of waste material has been treated, the plant components in question must be carefully cleaned.

8.3.3 Residues

In accordance with the requirements of no. 4.3, residues shall be recycled on a priority basis.

If residues cannot be recycled, they should be disposed of as follows:

- liquid residues from the organic treatment plant shall undergo heat treatment;
- sludge and solid residues from organic treatment plants shall be treated thermally unless they may be landfilled pursuant to no. 4.4.3;
- residues from inorganic treatment plants may be landfilled in line with the requirements pursuant to no. 4.4.3.

8.4 *Incineration plants*

8.4.1 Technical requirements

All toxic organic substances contained in the waste materials should be fully destroyed if possible. This shall be done, for example, by:

- a) the particular design of the incinerator device,
- b) the choice of the location and the nature of the air flow system,
- c) the layout and the setting of the burner elements
- d) turbulence generating inserts.
- e) control of the pressure conditions.

The incineration system shall be so designed that any slag arising can be drawn off easily while in a fluid state.

8.4.2 Operational requirements

An incineration plan is to be compiled in order to ensure that the objectives in 8.1 above are attained. This plan should guarantee a uniform rate of operation and avoid any overloading of the incineration system and or other downstream equipment.

When the incineration plan is being compiled, the following aspects in particular should be taken into account:

- a) preliminary treatment with the aim of standardising the waste material with regard to, for example, consistency, calorific value, pH value, chlorine and other halogens, sulphur, zinc, copper, mercury, cadmium and any other toxic organic or inorganic substances,
- b) transferring waste materials out of container in cases where the waste is not suitable for incineration,
- c) standardising the throughput and composition of waste in each charging element,
- d) determining the point of delivery and the time and duration of each waste processing stage,
- e) calculation of the energy requirements of the incineration process based on the energy type used.

8.4.3 Residues and waste water

When waste materials are incinerated, the following residues or wastewaters are generated:

- a) Residues
 - slag,
 - dusts, from the flue gas cleaning,
 - reaction products from the flue gas cleaning.
- b) Waste water:
 - waste water from the slag bath,
 - waste water from the flue gas cleaning,
 - condensate from the chimney,
 - cooling, rinsing, flushing and spraying water,
 - sludge water,
 - wastewater from the storage area.

8.4.3.1 Residues

Residues shall be recycled as a matter of priority in accordance with the terms of no. 4.3.

Residues in accordance with no. 8.4.3 a) shall be collected and stored separately provided mixing is permitted under these Technical Instructions.

Slags may contain no more than 3 per cent of organic substances, as defined in Annex B, no. 2.2. Slags containing more than 3 per cent of organic substances shall be collected separately and treated thermally.

Reaction products from flue gas cleaning shall be minimised through the nature, construction and operation of the flue gas cleaning installations.

8.4.3.2 Waste water

In addition to the requirements set out in no. 6.1.7, the different types of wastewater listed in no. 8.4.3 shall be collected separately unless mixtures are authorised within the scope of the present Technical Instruction.

8.5 Other requirements

Other requirements for waste incineration plants are contained in the 17th Ordinance on the Implementation of the Federal Immission Control Act (Ordinance on Waste Incineration Installations).

9 Specific requirements for ground-level landfill

9.1 Principle

In the case of ground-level landfilling, waste, if need be following relevant treatment, shall, in compliance with the following requirements be landfilled on a long-term basis within the area of influence of biospheres in such a way that

- a) by choosing a suitable site;
- b) by having suitable landfill insulation systems;
- c) by ensuring suitable enclosure techniques for the waste;
- d) by complying with the parameters pursuant to Appendix D

several barriers are created and possible releases and spreading of hazardous substances are prevented in line with state-of-the-art technology.

9.2 General provisions

In ground-level landfill, a separate area shall be established outwith the landfill; it shall be reserved for solid waste from transportation accidents and to secure falsely declared waste. The area shall be set up and equipped in such a way that it can accept a waste volume of at least 300 m³ and is suitable for as many types of waste as possible.

The requirements pursuant to no. 9 shall also apply to ground-level single-substance landfill pursuant to no. 4.4.3.3. If the parameters pursuant to Annex D, with the exception of DI are considerably lower than prescribed, exceptions may be permitted pursuant to no. 2.4.

9.3 Siting

9.3.1 General

Ground-level landfill may not be constructed in

- a) karst areas and areas with extremely fissured subterrain particularly with water conductivity,
- b) within designated, previously secured or planned drinking water areas or areas with medicinal springs or water provision areas (areas designated by town and country planning in the interests of securing future water supply),
- c) within a designated, previously secured or planned flood basin.
- a) Moreover, the following properties shall be described in the plan approval and licensing documents pursuant to Annex A and shall be checked on the basis as to the suitability of their siting,
- d) geological, hydrogeological and geotechnical conditions at the waste deposit site and in further ground water run-off area,
- e) the position as regards an existing or designated settlement area taking account of an adequate protective distance. Individual building developments shall be treated separately,
- f) the position in areas susceptible to earthquakes and tectonic disturbance zones,
- g) the position in areas where mountain subsidances have not yet abated or where landslides may be accepted because of former mining work.

9.3.2 Underground

A landfill shall be supported by natural underground conditions with a minimum thickness of 3 m and a high adsorption capacity. This provision shall in general met when the clay mineral belowground area of the abovementioned thickness formation permeability correction value is $k_f \leq 1 \times 10^{-7}$. The underground area required shall be spread out over a wide area.

Where the aforementioned preconditions are not met, they shall be implemented by means of additional technical measures. Where the landfilled material is subsequently topped up, the clay mineral content of the mineral material shall be at least 10 % by weight.

The degree of compression on the surface of the waste support (first layer above the landfill) shall be at least $D_{pr} \geq 95\%$. The requirements pursuant to no. 3.2.1.1 in Annex E shall apply.

9.3.3 Position in relation to ground water

The first layer above the landfill base shall be constructed in such a way that once the underground sinkages have faded, it remains at least 1 metre above the highest expected ground water surface or ground water pressure surface in water in the case of unconfined or confined ground water pursuant to DIN 4049 part 1 (September 1979 edition).

A higher piezometric level shall be permissible if it can be proven that the ground water that is an active part of the ground water cycle will not be affected detrimentally.

A detrimental effect such as this cannot arise in particular where the underground area consists of low-permeable soil or rock strata of sufficient thickness and spread out beyond the actual landfilling area.

9.4 Construction

In the storage section, the waste landfill shall be equipped with landfilling insulation systems. Moreover, draining water shall be sent to a draining water treatment plant.

9.4.1 Waste landfilling insulation systems

9.4.1.1 General provisions

Waste landfilling insulation systems shall be installed in line with nos. 9.4.1.3 and 9.4.1.4.

Deformations caused by surcharge of the insulation area must not have an adverse effect on the waste landfilling insulation systems. These deformations and sinkages shall be reckoned with unplastered penetrations of the insulation in the escarpment area shall be carried out in such a way that it can be controlled and repaired.

The provisions of Annex E shall apply. The suitability of plastic insulation shall as a rule be checked with the aid of a suitable expert, for example the Institute for Building Technology (*Institut für Bautechnik*), Berlin or the Federal Institute for Materials Testing (*Bundesanstalt für Materialprüfung*), Berlin. Testing obligations relating to other statutory provisions – for example building law in the licences or water law – shall remain unaffected.

Derogations to the provisions pursuant to paras. 1 to 3 for these waste landfilling insulation systems shall be permitted if it can be shown that alternative systems are equal in value. The provisions pursuant to para. 4 shall therefore apply *mutatis mutandis*.

A contractor shall be commissioned with the production of a waste landfilling insulation system.

An all-weather protection facility shall be provided for and, if need be, employed for the proper production of the waste landfilling insulation systems. In particular the provisions pursuant to nos. 3.1.1 b) and 3.1.2 d) in Annex E.

9.4.1.2 Quality assurance plan (pursuant to DIN 55 350)

A quality assurance plan shall be drawn up before production of the landfilling insulation systems. This plan shall contain the special elements of quality assurance and the responsibility to ensure material instruments and actions are laid down in such a way that the quality features for the landfilling insulation systems pursuant to no. 9.4.1.3 and no. 9.4.1.4 are met.

The quality assurance plan shall contain at least the following elements:

- a) the responsibility for the establishment, implementation and control of quality assurance,
 - b) the results of the suitability test for the necessary materials,
 - c) the measures to monitor and check quality during and after the production of the landfilling insulation systems,
 - d) the type of manufacture documentation (stock plans and information reports).
- a) In laying down measures to monitor and check quality pursuant to d), a differentiation shall be made between the following, mutually independent functions:
- e) self-monitoring by the manufacturer,
 - f) external monitoring by a third party with the agreement of the competent authority, for example by an external engineering firm and/or institute,
 - g) monitoring by the competent authority.

The quality check shall be carried out pursuant to no. 3.2 of Annex E.

The implementation of the external check ought not to entail any unreasonable delays in the production of landfilling insulation systems. If necessary, additional laboratory facilities shall be prepared to this end for soil mechanics investigations on the building site.

The competent authority shall be informed in good time of the start of each individual stage of work in the production of a landfilling insulation system.

9.4.1.3 Landfill base insulation systems

On the first layer above the landfill base pursuant to no. 9.3.2, a landfill base installation system shall be set up on the invert and the slope area. The requirements pursuant to no. 9.3.2 para. 4 shall apply to the top layer of the landfill.

Vertical penetrations of the insulation system shall be prohibited. In line with fig. 1, the landfill base insulation system shall consist of the following system components which will lie directly above each other and the material and checking requirements of which are set out in Annex E:

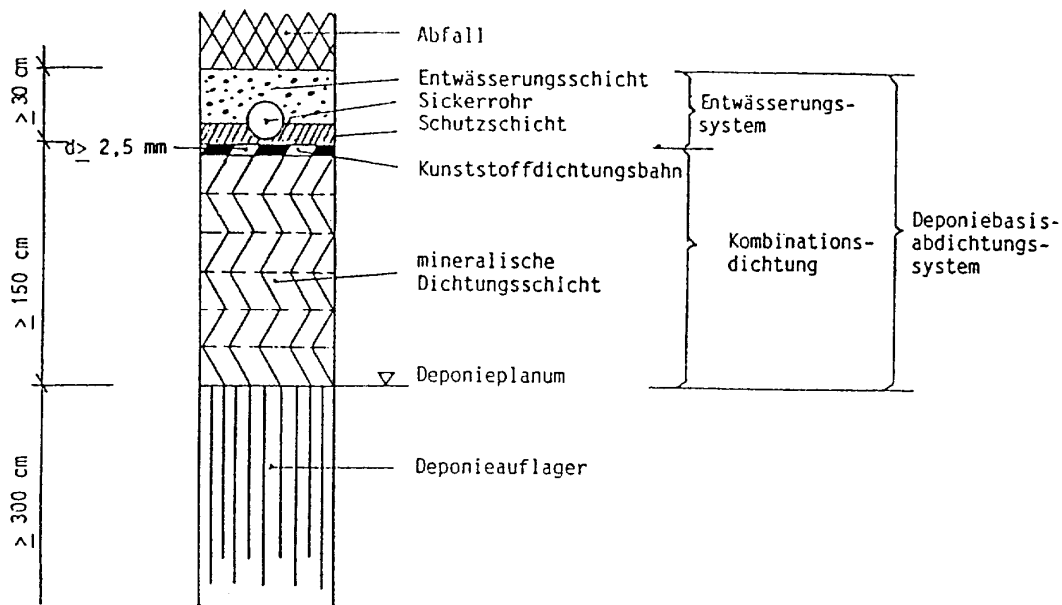
- a) The seal shall consist of a mineral sealing layer with a plastic sealing strip in the form of combined sealing. The thickness of the mineral sealing layer shall not be less than 1.50 m. A permeability correction value of $k \geq 5 \times 10^{-3} \text{ m/s}$ where $i = 30$ (laboratory value) shall be met. The plastic sealing strip shall have a thickness of $d \geq 2.5 \text{ mm}$. Suitable measures shall be taken to protect it from load-related damage.

The surface of the seal shall be shaped in the profile of a roof. Once the settlement of the landfill support has been completed, the surface of the sealing layer shall have a crosswise gradient of $\geq 3\%$ and an upright gradient of $\geq 1\%$.

- b) The drainage system shall be at least $d \geq 0.3 \text{ m}$ thick. The drainage system shall be flat and shall in the long term not exceed a permeability correction value of $k = 1 \times 10^{-3} \text{ m/s}$.

In addition perceptible and controllable drain pipes (collection points) and catch pits shall be provided to collect and release seepage water.

Fig. 1: Landfill base insulation system

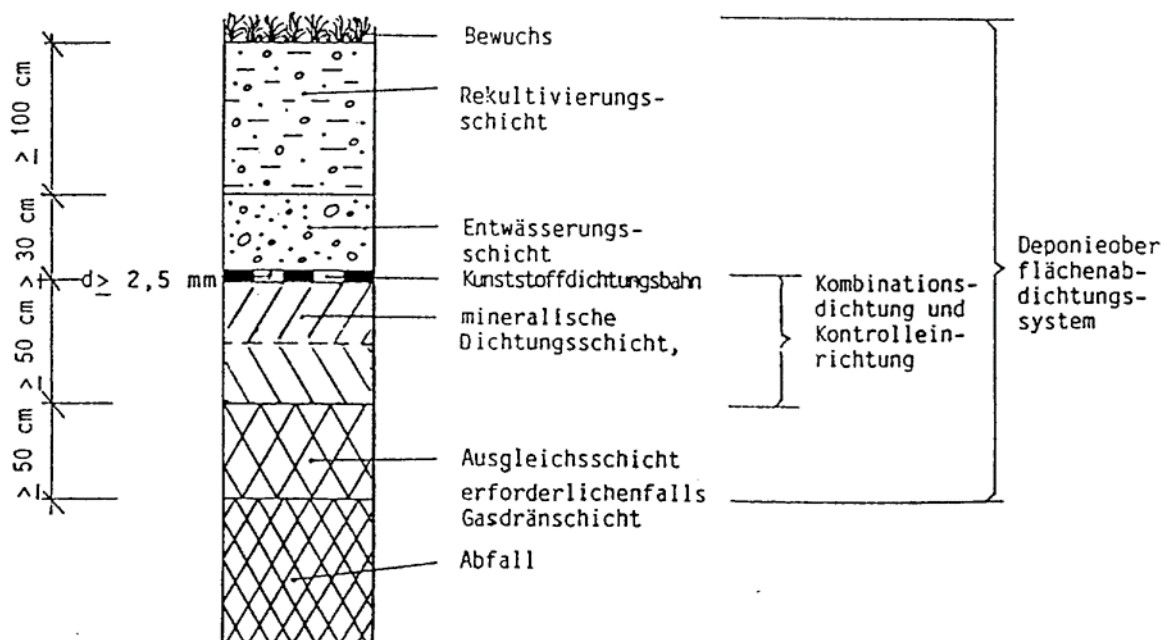


9.4.1.4 Landfill surface insulating systems

After each section of the landfill has been filled, a landfill surface insulating system pursuant to figure 2 shall be erected on the body of the landfill.

The landfill surface insulating system shall be constructed in such a way that leaks may be located and repaired throughout the post-operational period.

Fig. 2. Landfill surface insulation system



The following elements shall apply to the individual elements:

- a) A compacted neutralising layer shall be constructed as sealing support made from homogeneous, non-cohesive material. This shall not be less than 0.5 m thick. Where gas formation is determined and the gas cannot be collected and drawn of in the neutralising layer, an additional gas-draining

layer with a minimum thickness of $d = 0.3$ m shall be provided. The percentage of calcium carbon in the material of the degasification layer shall not exceed 10 % by weight.

- b) Sealing shall take the form of combined sealing. The thickness of the mineral sealing layer shall not be lower than 0.5 m. A permeability correction value of $k \leq 5 \times 10^{10}$ m/s given $i = 30$ (laboratory value) shall be adhered to. The plastic sealing strip shall be at least 2.5 mm thick.

Once the settlement of the landfill support has been completed, there shall be a gradient of $\geq 5\%$.

Nos. 1.1 b) and 3.1.1 k) in Annex E shall not apply.

- c) The provisions of nos. 9.4.1.3 b) sentences 1 and 2 shall apply to the drainage systems. Furthermore, it shall be necessary to calculate leachate levels and to draw up a hydraulic certification of the efficiency of the system.
- d) The recultivation layer shall consist of a layer at least 1 m thick of cultivateable soil, which shall be planted with suitable vegetation. It shall be laid out in such a way that the seal is protected from the effects of roots and of frost. The vegetation shall offer adequate protection against wind and water erosion.

In compliance with the meteorological range of data to be drawn up pursuant to no. 9.6.6.1 in conjunction with table 1 of Annex G and with due regard to the observations made on the state of the water regime, the vegetation shall, moreover, be chosen in such a way that the infiltration of rain water into the drainage system is minimised.

9.4.2 Leachate treatment installation.

Within the framework of the licencing procedure, the competent authority shall set the run-off value for the leachate treatment plant. Guidance shall be taken from Annex F in respect of the choice of leachate treatment.

9.5 *Stability of the body of the landfill*

The body of the landfill shall be constructed in such a way that it is mechanically stable without outside intervention and with respect to the surrounding area.

In planning the landfill, forecasts shall be made of the behaviour of the body of the landfill using theoretical assumptions. These assumptions shall be revised every 2 years based on the operation plan pursuant to no. 9.6.1. The results shall be attached to the annual evaluation of internal control pursuant to no. 9:6.6.2.

9.6 *Operation*

9.6.1 Operation plan

An operation plan shall be drawn up. The operation plan shall contain all-important provisions for the operation of the landfill, in particular for the construction of the body of the landfill pursuant to no. 9.6.4 for the collection and run-off of gas, leachate and other types of wastewater pursuant to no. 9.6.5 and for the type and extent of internal control pursuant to no. 9.6.6.1. The landfilling area shall be divided off into landfilling sections. For each landfilling section, the following information in particular shall be provided and taken into account during the planning stage:

- a) waste group pursuant to Annex C
- b) place of landfilling
- c) landfilling procedures.

9.6.2 Waste registers

A waste register shall be kept on the construction of each landfilling section, and the waste section divided up into set areas of at most 1,000 m² – larger in the case of single-substance landfill – and 2 m

in height. The following information at least shall be documented in the waste register for the waste landfilled in each set area:

- a) waste type/waste code, number of the disposal certificate, waste amount,
- b) place of landfilling (number of the net areas),
- c) landfilling procedures
 - a. layer thickness
 - b. layer gradient
 - c. insulation appliances, insulation work
- c) time of disposal
- d) deviations from the operation plan.

9.6.3 Stock plan

A stock plan shall be drawn up at least 6 months after a landfill section has been filled. The stock plan shall include and document the entire landfill section including the waste landfill base insulation systems.

The waste register shall be included in the stock plan.

9.6.4 Construction of the body of the waste landfill

9.6.4.1 Enclosure of the waste

- a) The body of the waste landfill shall be constructed in such a way that no detrimental reactions occur in the waste or with the leachate. If necessary, separate drained areas shall be provided for certain types of waste.
- b) In principle, efforts shall be made to construct the bodies of the waste landfills on a section-by-section basis so that each section can be filled as soon as possible and the landfill surface insulation system can be installed.
- c) The machines located in the grounds of the landfill shall as a rule ensure immediate landfilling and insulated enclosure of the waste delivered. Enclosure shall be carried out in such a way that, in the long term, only minimal settlement movements may be expected.
- d) The body of the landfill shall be constructed in such a way that its stability pursuant to no. 9.5 is guaranteed.
- e) Enclosure of the waste shall be insulated and non-cavernous.
- f) Particulate or intensively odorous waste shall be landfilled in such a way that they do not lead to any considerable emissions.
- g) Waste which of itself, in conjunction with water or in reactions with other waste may react exothermally; shall be landfilled in such a way that it does not cause temperatures of more than 25° C at the base of the landfill.

9.6.4.2 Reduction in leachate

In the construction of the body of the landfill, the formation of leachate shall be minimised. To this end, all areas in the body of the waste landfill that do not yet have a landfill surface insulation system shall be roofed over or covered, provided dampening of the waste is not required for technical or operational reasons.

9.6.4.2.1 Roofing

In the roofing procedure, the landfill insulation system shall not be damaged or put under inadmissible strain by supports or foundations. This must be mathematically proven.

9.6.4.2.2 Covering

Covering may be temporary or permanent.

Where the covering does not remain in the body of the landfill for an extended period, attention shall be given further landfilling on this enclosure area to ensure that

- a) the stability of the body of the landfill is guaranteed,
- b) the controlled run-off of leachate from the body of the landfill is guaranteed,
- c) the controlled collection and let-off gas from the body of the landfill is guaranteed where gas formations occur pursuant to no. 9.6.5.2.

9.6.5 Leachate, other water and gas

9.6.5.1 Leachate and other water

In the ground level landfilling of waste, the following types of water may arise:

- a) leachate from the landfill base insulation system,
- b) surface waters from landfill sections and areas on which no waste is landfilled,
- c) surface waters from otherwise polluted secured areas,
- d) waste water from the sample points, the laboratory, the point of transfer and the storage areas,
- e) surface water from the roofed or temporarily covered areas within the landfilling sector and from marginal ditches around the body of the landfill,
- f) surface water from landfilling sections with surface insulation,
- g) external inflows of water; for example surface water or layer water,
- h) wastewater from sanitation.

Wastewater pursuant to a) to h) shall, as far as required, be collected and treated separately.

Let-off of the water pursuant to b) to h) under the landfilling sector (verdo procedure) shall not be permitted.

9.6.5.2 Gas

Where significant concentrations of gas are measured within the framework of the internal control pursuant to no. 9.6.6.1, suitable facilities shall be employed to collect, let off and treat the said gas.

9.6.6 Internal control

By means of internal control on the part of the landfill operator or a party commissioned by him, proof shall be furnished that the provisions for landfill procedures are being met and that the proper running of the landfill and the functional operability of the landfill insulation system is guaranteed.

9.6.6.1 Measurement and control facilities

At least the following measurement and control facilities shall be provided and have their functionality checked at regular intervals:

- ground water monitoring system with at least one measuring point in the ground water run-off and at least 4 measuring points in the ground water run-off area of the landfill
- measurement facilities to monitor settlements and deformations of the landfill insulation systems and the body of the landfill
- measurement facilities for meteorological data collection
 - rain measurement facility
 - temperature measurement facility
 - wind measurement facility
 - evaporation measurement facility.

It shall be permissible to collect data from meteorological measurement stations at a similar site in the direct vicinity.

- measurement facilities to determine the amount and quality of leachate and other water.

Internal control shall be carried out and evaluated during the operational phase and in the post-operational phase of the landfill. The provisions of Annex G shall apply.

The data shall be recorded at one central point using electronic data processing.

9.6.6.2 Declaration on the behaviour of the landfill

The behaviour of the landfill shall be documented using the timescale of leachate amount and quality and, if necessary, gas emissions, temperature changes and behaviour with regard to settlement and deformation.

Based on the annual evaluation of the measurement results, a declaration on the behaviour of the landfill shall be drawn up and presented, with the annual survey, to the competent authority pursuant to no. 5.4.4.2.

The timescale of the behaviour of the landfill shall be included herein and compared with the theoretical assumptions made for the landfill pursuant to no. 9.5 and, if necessary, the assumptions made in the plan approval for the amounts and state of leachate and for gas emissions.

9.7 Closure of the landfill and post-operational care

9.7.1 Closure of the landfill

Once a landfill or a section of a landfill has been closed, the surface area shall be sealed pursuant to no. 9.4.1.4 and the measurement and control facilities for data collection pursuant to no. 9.6.6.1 installed.

The competent authority shall carry out a closing inspection taking into account the following:

- a) the annual declaration on the behaviour of the landfill,
- b) the annual evaluations of internal control,
- c) the functionality of the landfill insulation systems and the measurement and control facilities,
- d) the operational plan pursuant to no. 9.6.1 and the stock plan pursuant to no. 9.6.3.

9.7.2 Post operational care

Ground-level landfill require post operational care. The post-operational phase shall begin at the time of the closing inspection pursuant to no. 9.7.1.

In the post operational phase long-term safety measures in particular shall be taken and controls carried out in respect of the behaviour of the landfill pursuant to no. 9.6.6 and Annex G; both these safety measures and the controls shall be documented.

The landfill operator within the framework of internal control pursuant to no. 9.6.6 and Annex G shall carry out the controls and measures in the post-operational phase until the competent authority relieves him of the postoperational obligation.

10 Special requirements for underground landfill in salt rock

10.1 Basic principle

In the landfilling of waste in underground facilities in salt rock, waste shall be permanently kept away from the biosphere. Underground landfilling shall be carried out in such a way that no post-operational care is required.

In the case of underground landfills, a distinction shall be made between

- mines in salt rock pursuant to figure 3 (underground landfill - type 1) or
- caverns in salt rock pursuant to figure 4 (underground landfill - type 2).

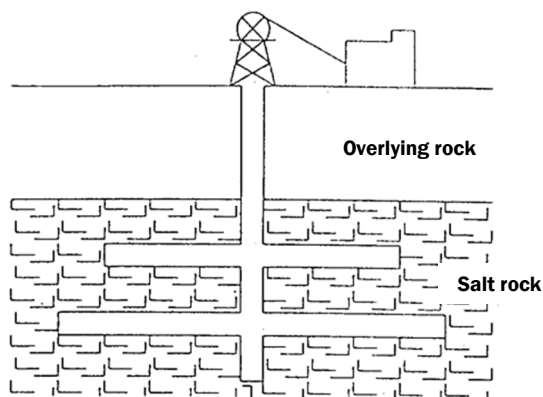


Fig. 3: Mine in saltrock (underground landfill type 1)

Characteristics:

- geological barrier: salt
- permanent exclusion from the biosphere
- insulation of the shafts in the groundwater-bearing overlying rock .
- no dewatering required
- waste in principle able to be retrieved during the operation period
- landfilling of receptacles, thick and rubble-like waste possible
- separate waste landfilling possible
- special insulation measures not required in the waste area; closure of individual chambers and sections possible
- gradual enclosure of the waste by convergence of the salt rock
- permanent dry landfilling of the waste by means of qualified closure of the shafts.

10.2 Site

The salt rock at the site shall

- be impermeable to fluids and gases,
- be of adequate size,

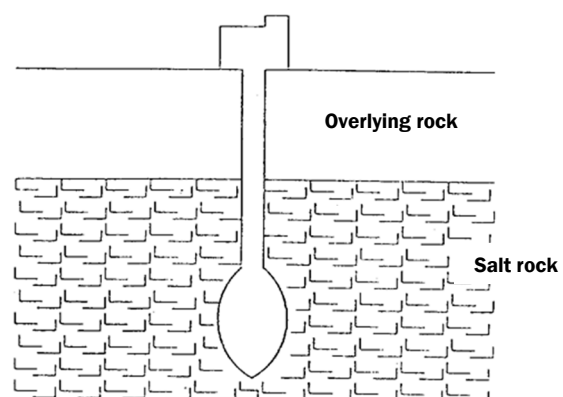


Fig.4: Cavern in salt rock (underground landfill type 2)

Characteristics:

- geological barrier: salt
- permanent exclusion from the biosphere
- insulation of the access hole in the groundwater overlying rock
- not accessible
- waste not able to be retrieved
- landfilling only in caverns pumped empty
- landfilling of rubble-like and pumpable waste with in-situ solidification
- separate landfilling of waste in one and the same cavern not possible
- gradual enclosure of the waste by convergence of the salt rock
- permanent dry landfilling of the waste by means of qualified closure of the mouth of the cavern and the access hole

- c) have an adequate thickness of salt in the chosen landfilling area.
- a) Furthermore:
- d) the geomechanical properties of the rock mass shall allow the constructions of solid cavities.
- e) the sites of the cavities shall not be in the vicinity of rock mass strata with the potential for carrying water (water warning line as in mining law),
- f) sites shall be avoided in which the regional earthquake intensity with a 99% probability exceeds value 8 on the MSK scale (MSK = Medwedjew-Sponheuer-Karnik).

10.3 Site related safety assessment

Proof of the suitability of the rock mass for the construction of an underground landfill shall be contained in a site-related safety assessment. This site-related safety assessment shall take account of the entire system - waste, underground construction and body of the rock mass.

The site-related safety assessment shall be based on the analysis of the risks possible in the construction phase, during operation and, during the post operational phase. The required control and safety measures shall be derived here-from. The following individual certificates of proof shall be contained in the site-related safety assessment:

- a) geotechnical site safety certificate,
- b) safety certificate for the operational phase,
- c) certificate of long-term safety.

10.3.1 Geotechnical site safety certificate

The site safety of the cavities shall be certified by suitable calculations e.g. pillar calculations. Account shall thereby be taken of the influence of the waste to be landfilled.

For the site safety of the cavities – if required in conjunction with an extension – it shall be individually certified that

- a) no deformations may be expected during and following the construction of the cavities either in the cavity itself or on the surface of the mine, which could disrupt the functionability of the underground landfill:
- b) the load capacity of the rock mass is adequate to prevent the collapse of the cavity,
- c) the landfilled material has a long-term stabilising effect.

The certification of site safety shall, if required, be checked by a rock mechanics report.

10.3.2 Safety certificate for the operational phase

A safety certificate shall be drawn up for the operational phase with the following individual certificates:

- a) certificate of the site safety of the cavities pursuant to no. 10.3.1,
- b) certificate of operational safety.

The certification of operational safety shall, based on installation-specific data on the waste inventory, the waste plan and the operational details contain a systematic analysis of the operation of the installation. Unwanted individual occurrences, which lead to a release of hazardous substances not foreseen for the operation, shall be identified, collated to form representative operational disturbances and classified. The effects of these operational disturbances shall be examined. Proof shall be furnished that the protection objectives are not impaired. Countermeasures to be taken if required shall be set down.

10.3.3 Certificate of long-term safety

A certificate of long-term safety shall contain proof that the construction, operation and post-operational phase of an underground landfill cannot lead to an impairment of the biosphere.

This shall include the posulation and evaluation of the barriers of the underground landfill (e.g. waste properties, filling and sealing of the shafts and boreholes), the behaviour of the salt rock, the surrounding rock and the rock mass, and occurences in the entire system, by means of suitable models based on specific site data or adequately conservative assumptions. Attention shall be given to the geochemical and hydrogeological conditions such as evaluation of ground water and the potential for solving problems (effectiveness of the barriers).

Because their functionability is limited in time, receptacles and cavity coatings may not be used in the landfilling procedure to guarantee long-term safety.

10.4 Construction

10.4.1 Mines in salt rock (underground landfill - type 1)

10.4.1.1 Hoisting facilities

The shaft hoisting facility shall be conceived as

- a) cage hoisting or
- b) piping.

Pipelines in the shaft shall be accessible at all points via a correspondingly constructed men-riding installation or accessibility facility.

The pipelines shall be measured in such a way that they are safe to withstand at least three times maximal possible strain.

Pipelines for main-line haulage must be easy separable at the joints in order to be able to remove clogging.

If waste is transported in receptacles, main-line haulage shall be trackless (e.g. lorries) or rail-based (e.g. mine railways, single-track pithead railways). The transportation vehicles shall be fitted with facilities to prevent the receptacles from falling.

10.4.1.2 Storage areas in the vicinity of the filling site

If waste is transported in receptacles, storage areas shall be provided in the transfer section from shaft hoisting to main-line haulage. This area shall be constructed in such a way that it can accept at least one-day's delivery.

10.4.1.3 Landfilling area

Before landfilling begins, mine openings shall be constructed in the waste landfilling area for this purpose. These include, for example,

- a) the safeguarding of the back slope
- b) the construction of carrageways
- c) sealing, intermediate closures
- d) construction of air monitoring facilities.

Where available mine openings are used to landfill waste, the construction work on these openings (primary blasting, ramming, bolting, construction of carriageways) shall be done in such a way that harmful influences to waste and its packaging landfilled elsewhere are avoided.

Where mine openings are re-opened for waste landfilling these shall be harmonised with the special requirements of waste landfilling technology.

Where mineral extraction is taking place in a mine at the same time as waste landfilling, the waste landfilling area shall have an adequate support pillar against the extraction area.

If, for operational reasons, the support pillar has to be cut through, the waste area shall at all times be able to be sealed off from the extraction area.

10.4.1.4 Ventilation

If landfilling and mineral extraction takes place in one mine, the ventilation of both parts of the underground operation shall be carried out separately. The airways and the landfilling shall be harmonised with each other in such a way that adequate fresh air is directed to the mine openings in which the waste is stored and the air emanating from the waste landfilling area directly reaches the vitiated air. The main flow of fresh air shall be divided between the extraction area and the landfilling area.

The vitiated air from the landfilling area shall be directed to the vitiated airshaft without coming into contact with the extraction area. In front of this shaft or even in it, the vitiated air from the waste area and from the extraction area may be reunited.

The air reaching the atmosphere from the vitiated airshaft shall not, in conformity with the relevant provision under emission control laws, contain any concentrations of hazardous substances harmful to the environment.

10.4.1.5 Collecting receptacles

Collecting receptacles and basins shall be held at the ready to ensure immediate retrieval in the case of the unplanned release of waste from receptacles or pipelines. For retrieval work, special body protection equipment and, if need be, breathing equipment shall be provided for carrying out such work.

10.4.2 Caverns in salt rock (underground landfill - type 2)

10.4.2.1 Construction of a cavern

In the construction of caverns in which to landfill waste, these shall, in respect of rock mechanics, be conceived in such a way that they are stable when exposed to atmospheric internal pressure during the operational phase.

10.4.2.2 Use of an available cavern

Where use is made of an available cavern as an underground landfill, stability may also be guaranteed by taking account of support pressure. This shall include consideration of a hazardous incident with temporary relief to atmospheric pressure.

10.4.2.4 Treatment of outgoing air

Where significant concentrations of hazardous substances are measured in the outgoing air in emission and immission control pursuant to no. 10.5.5.3, suitable facilities shall be employed to collect, lead off and treat them.

10.4.2.5 Filling facilities

To fill the cavern, the waste shall be conveyed through an additional column to be installed in the cemented casing in the access hole. This column shall be able to be extended and replaced.

Conveyance shall take the form of

- a) pneumatic transportation,
- b) hydraulic transportation or

- c) tipping via a free fall pipeline

10.5 Operation

Landfilling shall be carried out in such a way that cavities shall be filled with waste as far as possible completely and evenly. Landfilling shall be controlled to ensure that the load capacity of the rock remains safe and that in the long-term a balance in rock mechanics is guaranteed between the waste landfilled and the salt rock.

Where the waste is conveyed in a state able to be pumped, it shall be conditioned in such a way that it reaches the required consistency in the underground landfill. Where solid, sludge-like or liquid waste is conveyed as suspension with a hydraulic bonding agent, the liquid phase must be solidified using the bonding agent in the landfilling area. The bonding agent itself may be waste.

Where this landfilling technique is used, the following influencing factors shall be taken into account:

- a) conveyance capacity of the suspension
- b) behaviour of the suspension in relation to the conductive material
- c) the rheological properties of the suspension during conveyance and sedimentation
- d) solidification behaviour
- e) formation of heat during the solidification process
- f) interaction between the conveyance medium and waste, and between suspension and salt rock.

During waste loading, provision shall be made to avoid blockages in the filling duct.

Where different types of waste are landfilled, it shall be ensured that they do not react with one another. Where reactions of this kind are possible or cannot be excluded, each different type of waste shall be landfilled in a separate cavity. This shall also apply to waste landfilled in receptacles.

10.5.1 Mining in salt rock (underground landfill type 1)

Receptacles deposited in the filling area shall immediately be transported further to the landfilling area.

Where the waste is conveyed pneumatically, it shall be ensured that no inadmissible emissions, in particular of particulates, emanate from the landfilling area. This shall also apply to the landfilling of tippable, loose waste. To this end, measures shall be taken to ensure the earliest possible sedimentation of the particulates as possible. Occupied mine workings shall not be affected by particulate movements.

Where the waste is conveyed hydraulically, the pumpable waste must harden after landfilling without losing liquid.

Receptacles shall be landfilled in such a way that their protective function throughout the operational phase is retained.

The site safety of the landfilled waste shall be guaranteed. Where receptacles are landfilled in layers one on top of the other, the site safety of the entire stack shall be guaranteed.

Landfill sections pursuant to no. 10.5.2 shall be separated from the mine workings after loading by means of the following measures, which may be applied individually or jointly:

- separation of the air supply by an air aperture or by walls,
- installation of bleeder sampling pipes to detect possible gas formations
- closure of access routes by using salt or saliferous concrete.

Where provision is made for sealing off parts of the landfilling area, this shall have been completed before the end of the operational phase.

10.5.2 Landfilling plan

A landfilling plan shall be drawn up. The landfilling plan shall contain all-important provisions relating to the filling of underground cavities with waste.

The landfilling area shall be divided into landfill sections. For each landfill section, the following information in particular shall be given on the waste to be landfilled and shall be taken into account during planning:

- a) waste group pursuant to Annex C,
- b) place of landfilling
- c) landfilling procedure.

10.5.3 Waste register

The whereabouts of the waste in the underground site shall be documented in a graphic- and tabular-based waste register that can be ascertained at all times and contains

- a) waste type/waste code, number of the disposal certificate, waste volume,
- b) place of landfilling,
- c) landfilling procedure,
- d) time of landfilling,
- e) divergencies from the waste plan.

Waste, which is transferred to another landfill or removed from the landfill, shall be registered as losses and information shall be provided on the subsequent whereabouts of the waste.

10.5.4 Inventory plan

An inventory plan shall be drawn up at least six months after a landfill section has been filled. The inventory plan shall document the entire landfill section including the sealing-off structure.

The waste register shall be included in the inventory plan.

10.5.5.1 Internal controls

Internal controls serve to ensure that the requirements are being met for the erection and operation of underground landfill. Regular controls shall take place during erection and operation and during the post-operational phase.

10.5.5.1 Surface controls

To determine the effects on the ground-level area, a survey grid shall be installed above the mine working or caverns used for waste landfilling and be measured using high-precision techniques at intervals to be determined by the competent authority. The first measurement (the so-called zero measurement) shall be carried out before leaching or operation of the underground landfill begin. Assessments shall be made of the results of the measurements.

The measurements and the corresponding recordings shall continue to be made even after the end of operations until such time as the competent authority releases the operator from this obligation.

10.5.5.2 Control of the well functioning of shaft and haulage conveyance systems.

Controls shall be carried out at regular intervals to control the well functioning of shaft and haulage systems in mines.

This shall include checks on the thickness of the sides of the ducts using non-destructive material tests. In the case of shaft conveyance systems, this shall be carried out regularly directly below the suspension; in the case of haulage conveyance, spot-tests shall be carried out at points particularly under strain.

10.5.5.3 Emission and immission control

The following emission and immission controls shall be required at intervals laid down by the competent authorities:

- a) gas measurement in the installation,
- b) particulate measurement in the installation,
- c) measurement of vitiated or outgoing air,
- d) measurement of noise level,
- e) ground level immission measurements.

Records shall be kept of measurements pursuant to c) above and shall be kept for a minimum of five years.

10.5.5.4 Control of the well-functioning of the facilities

Proof shall be furnished of the well functioning of individual parts of the installations, the facilities and the measuring instruments within the framework of preventative maintenance by means of regular inspection, check patrols, examinations and maintenance work. The intervals between checks on and calibration of the measuring instruments shall be chosen in line with the manufacturer's instructions. Checks and calibration shall, however, be carried out at least every five years.

10.5.5.5 Checks on the height of the filling column

Following the end of the measures taken to close the mine, the height of the filling column to be constructed pursuant to no. 10.6.1 shall be checked annually, and after 20 years every five years.

10.6 Closure measures

When an underground landfill has concluded operation, measures shall be taken to ensure that the waste landfilled is securely excluded from the biocycle.

Before the landfilling ground comes into operation, it must be proven that it is technically possible to close it in this way. Before the underground landfill concludes operation, plans shall be made for the closure measures using the best available technology. The plans shall be passed on to the authority responsible for granting licences relating to waste and mining activities.

Apart from preparatory measures aimed at reusing the site concerned, such as the retreating of parts of the facility, the most important part of the closure measures shall be the filling up of the shafts and other points of access in line with the requirements set out in nos. 10.6.1 and 10.6.2.

A safety area shall be set up in lot of land around the shafts and other access points of type 1 underground landfill; this area shall be sealed off and permanently marked. These areas shall be excluded from any possible use of the land and shall be additionally secured by means of a construction ban zone, the size of which shall be determined by the competent authority.

After the closure of a type 2 underground landfill, measures shall be taken to make the land reusable.

When notice is given of an end to waste landfilling, the competent authority shall be given verifiable documents on the closure measures.

10.6.1 Mines in salt rock (underground-landfill type 1)

When waste, landfilling comes to an end and before closure measures begin, a final rock monitoring measurement shall be taken underground.

The technical construction of the filling column shall be determined under the aspect of the geological profil and the expansion in each individual case.

Filling shall meet the following requirements:

- a) The entire length of the shaft or other point of access shall be filled.
- b) Filling shall be carried out in such a way subsequent setting in the filling column is kept to a minimum.
- c) Filling shall prevent any contact between the landfilling area and the biosphere in the long term.

At surface-level, the shaft and other points of access shall be sealed off with a massive slab of suitable material (e.g. concrete). The seal-off shall take place in such a way that the filling column underneath it can be checked in line with no. 10.5.5.5.

Where an underground landfill is operated in conjunction with a salt mineral extraction and mine continues longer than landfilling, a hydraulically thick seal based on hydrostatic pressure shall be installed against the extraction area in the waste landfilling area after landfilling has ended. The hydrostatic pressure shall be related to the depth of the sealing construction.

10.6.2 Caverns in salt rock (underground landfill type 2)

A sealing facility shall be constructed in the area around the roof of the cavern and the cavern neck. The final cemented casing pipe string shall be filled with suitable sealing material.

The sealing of the neck of the cavern shall take place in such a way that both the afflux of ground water and formation water to the waste landfilled and the release of hazardous substances into the biosphere are prevented. At least the following requirements shall be met:

- a) The long-term stability and the lack of need for maintenance of the sealing facility shall be guaranteed.
- b) The sealing effect of the sealing facility shall be similar to that of the natural salt rock or associated strata.
- c) In order to ensure a speedy sealing effect, a speedy form closure and frictional connection between the sealing facility and the salt rock shall be guaranteed.
- d) The sealing material shall be adjusted to suit the compactness properties of the surrounding area.
- e) The type and properties of the sealing material shall be harmonised with the surrounding area.
- f) The drop in volume of the sealing material after application shall be small.

11 Requirements for existing facilities

11.1 General provisions

In respect of the waste disposal facilities in operation when these Technical Instructions enter into force (existing facilities), the competent authorities shall issue subsequent instructions pursuant to Art. 8 para 1 sentence 2 and Art. 9 of the Waste Avoidance and Waste Management Act by 1 October 1991 subject to the condition that the requirements

- a) pursuant to no. 5 be met by 1 October 1992 at the latest and
- b) meet those pursuant to nos. 6 and 8 by 1 October 1995 at the latest.

11.2 Ground-level landfill

In respect of existing landfill, the competent authority shall

- a) issue subsequent instructions pursuant to Art. 8 para 1 sentence 3 or Art. 9, Waste Avoidance and Waste Management Act subject to the condition that a retrofitting programme be drawn up and that complete and verifiable plans be made available within one year following the issue of the instructions. Note shall be taken of the provisions of e) to i),
- b) come to a decision with regard to licensing pursuant to Art. 7 para 2, Art. 8 para 1 sentence 3 or Art. 9 of the Waste Avoidance and Waste Management Act at least one year after submission of the plans pursuant to a),
- c) operate the procedure until expiry of the deadline for objections at least one year after submission of the plans pursuant to a) on licensing pursuant to Art. 7 para 1 of the Waste Avoidance and Waste Management Act,
- d) grant a licence on condition that the requirements pursuant to e) to i) be met at least two years after the final licencing decisions.

The following requirements at least shall be applicable to existing landfill:

- e) The landfill shall meet the requirements for stability pursuant to no. 9.5 and for operation pursuant to no. 9.6.
- f) Landfill surface insulation systems shall meet the requirements of nos. 9.4.1.1 paras 2 to 7, 9.4.1.2 and 9.4.1.4. For landfill sections that were already recultivated when these Technical Instructions come into force, exceptions shall be permitted if proof can be given that the body of the landfill is protected from possible water inflow.
- g) For landfill or landfilling sections on which no waste had yet been landfilled when these Technical Instructions come into operation, the following shall apply:
 - the requirements pursuant to no. 9.3.2 shall apply to underground areas and
 - the requirements pursuant to no. 9.4.1.1 paras 2 to 7, 9.4.1.2 and 9.4.1.3 shall apply to landfill base insulation systems.
- h) The provisions of no. 9.4.2 shall apply to the treatment of seepage water.
- i) An interim insulation system shall be installed in operational landfill sections. The requirements pursuant to no. 9.4.1.1 paras 2 to 7, 9.4.1.2 and 9.4.1.4 b) and c) shall apply to the interim insulation system.

This shall not be required for single-substance landfill for sludge-like material or where proof can be furnished that the infusion of leakage into ground water can be prevented using state-of-the-art technology.

In the case of existing facilities (landfill or landfill sections) taken out of circulation after these Technical Instructions come into effect, the competent authority shall carry out a closing inspection pursuant to no. 9.7.1.

12 Transitional provisions

12.1 Assignment of waste

12.1.1 Basic principle

The competent authority shall issue subsequent instructions pursuant to Art. 8 para 1 sentence 3 and Art. 9 of the Waste Avoidance and Waste Management Act by 1 October 1991 to ensure the requirements pursuant to nos. 4.4 and 4.1 para 2 are met.

12.1.2 Exceptions to waste assignments

The assignments of waste to CBP, SAV or UTD shall not apply where the waste producer furnishes proof in the disposal certificate that the waste cannot be disposed of within the area of validity of the Waste Avoidance and Waste Management Act because of insufficient treatment capacity or insufficient underground landfilling capacity.

In these cases, the waste may be landfilled

- in existing sites pursuant to nos. 11.2 and 12.2 notwithstanding the requirements of nos. 4.4.2.1 and 4.4.3.3,
- on transitional single-substance sites pursuant to no. 12.3.

Proof shall be deemed to be furnished for the entire period of validity of the disposal certificate unless the competent authority determines that new disposal capacities are available due to the setting up of a new facility or the expansion of the capacity of an existing facility. In this case, the competent authority can demand additional proof that disposal pursuant to nos. 4.4.2 or 4.4.3.2 in conjunction with no. 4.1 para 2 is even then not possible.

In the case of existing facilities, waste, the type and volume of whose leachage may be assessed, may continue to be allocated to ground level single-substance landfill where individual assignment criteria pursuant to Annex D are exceeded.

In these cases, where D 1 is not met, it must be shown that safe recultivation of the landfill and adequate stability can be achieved following landfilling or after subsequent treatment.

12.2 Landfilling on existing landfill

Until 1 April 1997, waste, which cannot be disposed of pursuant to nos. 4.4.2 or 4.4.3 in conjunction with 4.1 para 2, shall continue to be permitted to be landfilled on existing landfill pursuant to no. 11.2.

The competent authority shall issue subsequent instructions pursuant to Art. 8 para 1 sentence 3 or Art. 9 of the Waste Disposal and Waste Management Act on condition that landfilling may only take place after 1 April 1992 if lower mobilisation levels in the substances contained in the waste landfilled can be guaranteed by specific measures. This can take place, for example

- a) the bondage of hazardous substances, where this causes no impairment to the behaviour of the landfill and the quality of the waste being dealt with cannot deteriorate to any significant degree, Annex H shall apply to compaction.
- b) Encapsulation of the waste in the body of the landfill e.g. in clay lenses.

The effectiveness of these measures shall be checked and documented throughout operation and in the post-operational phase. This shall include checks on consistency and leachage behaviour taken over a number of years.

12.3 Landfilling on transitional single-substance landfill

Until 1 April 1990, waste which cannot be disposed of under nos. 4.4.2 or 4.4.3 in conjunction with no. 4.1 para 2, whose properties are the same and which arise during specifically defined procedures; may be landfilled on newly erected single-substance landfill or on newly erected single substance landfill sections in existing landfill.

At least the requirements pursuant to no. 9 apply to these transitional single-substance landfills with the exception of no. 9.3.1. Furthermore, additional barriers shall be provided against the release and escape of hazardous substances. In the choice of additional barriers, account shall be taken of the fact that the waste to be landfilled does not correspond to the assignment criteria pursuant to nos. 4.4.3.1 or 4.4.3.3. Barriers may for example consist of:

- particular geological conditions at certain sites,
- more extensive requirements for the landfill insulation system,
- the bondage of hazardous substances. In case of compaction, Annex H shall be taken into account,
- encapsulation of the waste.

The effectiveness of these barriers shall be checked and documented during operation and in the post-operational phase.

13 Entry into force

These Technical Instructions shall enter into force on 1 April 1991.

The Federal Council has given its approval.

Appendix A

Documents for applications for authorisation of waste management installations in plan approval and licencing procedures

Appendix B

Sampling and analysis procedures

Not included in English translation

Appendix C

Catalogue of Waste Requiring Special Supervision

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
10000	VEGETABLE AND ANIMAL WASTES (INCL PROCESSING)								
11000	food wastes								
11400	wastes from luxury food production								
11420	tobacco smoke condensate				1				
11421	rinsing and washing water with noxious contaminations, organically polluted		1		2				
12000	waste from production of animal and vegetable fat								
12100	waste from manufacturing of vegetable and animal fat products								
12102	vegetable oils				1				
12300	waste from production of vegetable and animal fats and waxes								
12303	residues of wire pulling lubricant				1		1		
12304	fatty acid residues				1				
12500	emulsions and mixtures with vegetable and animal fat products								
12503	oil, fat and wax emulsions		1		2				
13000	wastes from animal raising and meat packing - wastes from slaughtering of animals, to the extent such animals are not subject to the ANIMAL CARCASS DISPOSAL ACT (e.g. stomach contents, intestinal contents, fat separator residues/flotates), - animal carcass meal from processing of contaminated animal carcass (e.g. hormones, HCHs, PCBs), carcasses of animals living in the wild, to the extent such animals are not subject to the Animal Carcass Disposal Act								

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
13700	<i>animal feces from mass raising</i>								
13705	infectious manure		2		1				
14000	<i>skin and leather wastes</i>								
14400	<i>tanning wastes</i>								
14401	ashing sludge		1			2	1		
14402	tanning sludges		1			2	1		
17000	<i>wood wastes</i>								
17200	<i>wood wastes arising from applications</i>								
17208	posts and masts, cyanidized						1		Mono-landfill
17211	saw dust and wood chips, oil-saturated or with mainly organic noxious contaminants			2	1				
17212	saw dust and wood chips with mainly inorganic noxious contaminants			2		2	1		
17213	waste wood and containers with noxious contaminants, mostly organic			2	1				
17214	wood waste and containers with noxious contaminants, mostly inorganic					2	1		
18000	<i>cellulose and paper cardboard wastes</i>								
18700	<i>paper and cardboard-waste</i>								
18710	paper filters with mainly organic noxious contaminants			2	1				
18711	paper filters with mainly inorganic noxious contaminants					2	1		
18712	cellulose sheets with noxious contaminants, mostly organic			2	1				
18713	cellulose sheets with noxious contaminants, mostly inorganic					2	1		
18714	packaging material with noxious contaminants, mostly organic			2	1				
18715	packaging material with noxious contaminants, mostly inorganic					2	1		

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
30000	MINERAL WASTES (INCL. PROCESSING)								
31000	<i>mineral wastes (without metal wastes)</i>								
31100	<i>furnace linings, scrap from metallurgical plants and foundries</i>								
31108	furnace linings from metallurgical processes, with noxious contaminants					2	1		Mono-landfill.
31109	furnace linings from non-metallurgical processes with noxious contaminants					2	1		Mono-landfill
31200	<i>metallurgical slags, drosses and dusts</i>								
31203	slags from non-ferrous metal smelts						1		
31204	lead dross		1				1		Mono-landfill
31205	light metal drosses, containing aluminium		1				1		
31206	light metal drosses, containing magnesium						1		Mono-landfill
31211	salt slags, containing aluminium						1		Mono-landfill
31212	salt slags, containing magnesium						1		
31213	tin ashes						1		
31214	lead ashes						1		
31215	blast furnace dust					2	1		
31217	filter dusts containing non-ferrous metals						1		Mono-landfill
31300	<i>ashes, slags, dusts from incineration</i>								
31309	filter dusts from waste incineration plants					1*	1		Mono-landfill* only in special areas of der HMD
31310	slags from hazardous waste incineration plants						1		Mono-landfill
31311	filter dusts from hazardous waste incineration plants						1	2	
31312	solid reaction products from scrubbers in waste incineration plants						2	1	Mono-landfill

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
31313	solid reaction products from scrubbers in special waste incineration plants						2	1	Mono-landfill
31314	solid reaction products from scrubbers in incineration plants, without flue gas desulphurisation gypsum						1		Mono-landfill
31316	solid residues from pyrolysis plants						1	1	Mono-landfill
31400	other solid mineral wastes								
31419	dusts from slag processing				1	1			Mono-landfill
31423	oil contaminated soil		1		1*	2	2		Mono-landfill* special incineration plant
31424	soil with other noxious contaminants		1			2	1		Mono-landfill
31426	casting sands					2	1		Mono-landfill
31428	spent oil binders			2	1	2			
31430	mineral fiber wastes with noxious contaminants				2	2	1		
31433	glass and ceramics wastes with noxious contaminations						1		Mono-landfill
31435	spent filters and absorbants with noxious contaminants (diatomaceous earth, activated earth, activated charcoal)				1		1		
31437	asbestos dusts, spray asbestos		1						
31439	mineral residues from gas scrubbing					2	1		Mono-landfill
31440	blasting residues with noxious contaminations					2	1	1	Mono-landfill
31441	rubble and top soil with noxious contaminations						1		Mono-landfill
31445	waste gypsum with noxious contaminants						1		Mono-landfill
31446	silicate wastes with noxious contaminants, mostly organic				1				

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
31447	silicate wastes with noxious contaminants, mostly inorganic						1		
31600	<i>mineral sludges</i>								
31610	enamel sludge, enamel slip		1			2	1		
31619	sludge from top gas scrubbers of blast furnaces					2	1		
31620	gypsum sludge with noxious contaminants						1		Mono-landfill
31621	calcium carbonate sludge with noxious contaminants						1		Mono-landfill
31623	calcium phosphate sludge						1		Mono-landfill
31624	iron oxide sludge from reductions						1		Mono-landfill
31626	sludge from non-ferrous metallurgy						1		Mono-landfill
31628	tempering sludges containing cyanides		1					1	
31629	tempering sludges containing nitrates/nitrites		1					1	
31630	barium carbonate sludge						1		
31631	barium sulfate sludge					2	1		Mono-landfill
31632	barium sulfate sludge, containing mercury						1	1	
31633	glass grinding sludges with noxious contaminants						1		Mono-landfill
31636	drilling sludge with noxious contaminants					2	1		Mono-landfill
31637	phosphatizing sludge						1		
31639	other sludges from precipitation and solution, with noxious contaminants		1				1		Mono-landfill
31640	suspensions of fillers and release agents with mineral solids		1		1		1		
31641	calcium fluoride sludge					2	1		Mono-landfill
31642	residues from boiler-water scrubbers		1			2	1		
35000	<i>wastes containing metal</i>								
35100	<i>iron and steel wastes</i>								

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
35106	iron containers with noxious residual contents				1		1		
35107	oil filters				1				
35300	wastes containing non-ferrous metals								
35302	lead wastes						1		
35307	wastes containing beryllium						2	1	
35308	wastes containing magnesium		1				1		
35309	wastes containing zinc						1		
35315	other wastes containing non-ferrous metals, free from aluminium and magnesium wastes					2	1		
35317	dust containing aluminium		1				1		
35323	rechargeable nickel-cadmium batteries						2	1	
35324	batteries containing mercury						2	1	
35325	dry batteries (dry cells)						1	2	
35326	mercury, residues containing mercury, mercury vapour lamps, fluorescent tubes		1				2	1	
35327	non-ferrous metal containers with noxious residual contents				1		1		
35500	metal sludges								
35501	zinc sludges						1		
35503	lead sludge						1		
35504	tin sludge						1		
35505	anode sludge						1		
35506	other metal sludges, free of aluminium, iron and magnesium sludge						1		
39000	other wastes of mineral origin including wastes from refining processes								
39900	other wastes of mineral origin and wastes of processed products								
39902	jarosite sludge						1		Mono-landfill

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
39903	rock salt residues (gangue)					2		1	Mono-landfill
39904	gas scrubbing materials and pipe dust						1	1	
39905	fire extinguisher powder					2	1		
39906	skorodite sludge						1		
39907	residual elementary sulfur						1		
39908	glass mixture residues					2	1		Mono-landfill
39909	other solid mineral wastes with noxious contaminants						1		
50000	WASTES FROM SYNTHESIS AND CONVERSION PROCESSES (INCL. TEXTILE WASTES)								
<i>51000</i>	<i>oxides, hydroxides, salts</i>								
<i>51100</i>	<i>galvanizing sludges, metal hydroxide sludges</i>								
51101	galvanizing sludges containing cyanide		1				2		
51102	galvanizing sludges containing chromium(VI)		1				2		
51103	galvanizing sludges containing chromium(III)		1				1		
51104	galvanizing sludges containing copper		1				1		
51105	galvanizing sludges containing zinc		1				1		
51106	galvanizing sludges containing cadmium		1				1		
51107	galvanizing sludges containing nickel		1				1		
51108	galvanizing sludges containing cobalt		1				1		
51111	galvanizing sludges containing lead or tin		1				2		
51112	other galvanizing sludges		1				2		
51113	other metal hydroxide sludges		1				1		Mono-landfill
<i>51300</i>	<i>other oxides and hydroxides</i>								
51301	zinc oxide, zinc hydroxide						1		
51304	brownstone, manganese oxide						1		

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
51306	chromium(III) oxide						1		
51307	copper oxide						1		
51310	other metal oxides and metal hydroxides, free of ferric and aluminium oxides and hydroxides						1	1	Mono-landfill
51500	salts								
51502	skinning salts						2	1	
51503	sodium and potassium phosphate wastes						2	1	
51504	impregnating salt wastes						2	1	
51505	leather and tanning chemicals						2	1	
51507	fertilizer residues						2	1	
51508	alkaline carbonates						2	1	
51509	ammonia solution (ammonium chloride)						2	1	
51511	salt bath wastes						2	1	
51512	ammonium hydrogen fluoride						2	1	
51513	arsenolite						2	1	
51516	surface finishing (bronzing) salts wastes						2	1	
51517	sodium sulfate (Glauber's salt)							1	
51518	sodium bromide						2	1	
51519	ferric chloride						2	1	
51520	ferric sulfate						2	1	
51521	lead sulfate						1	1	
51523	sodium chloride							1	
51524	lead salts						2	1	
51525	barium salts							1	
51526	calcium chloride						2	1	
51527	magnesium chloride						2	1	
51528	alkaline and earth alkaline sulfides						2	1	
51529	heavy metal sulfides						1	2	
51530	copper chloride						2	1	
51531	aluminium sulfate and aluminium phosphate residues						2	1	
51532	chloride of lime		1				2		
51533	salts, containing cyanides						2	1	
51534	salts, containing nitrates or nitrites						2	1	

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
51535	vanadium salts						2	1	
51538	borax residues						2	1	
51539	arsenic compounds						2	1	
51540	other salts, soluble						2	1	
51541	other salts, poorly soluble						1		
51543	spent copper etching solutions		1						
52000	<i>acids, alkaline solutions and concentrates</i>								
52100	<i>inorganic acids</i>								
52101	rechargeable-battery acids		1						
52102	inorganic acids, mixtures and pickling solutions (acidic)		1						
52200	<i>organic acids</i>								
52201	halogenated organic acids				1				
52202	non-halogenated organic acids		2		1				
52400	<i>alkaline solutions</i>								
52402	alkaline solutions, mixtures and pickling solutions		1						
52403	ammonia solutions (liquid ammonia)		2		1				
52700	<i>concentrated solutions</i>								
52701	hypochlorite brine (chlorine bleaches)		1						
52707	fixing baths		1		2				
52708	sulfite pulping waste				1				
52710	tanning baths		1		2				
52712	concentrates and semiconcentrates containing chromium(VI)		1						
52713	concentrates and semiconcentrates containing cyanides		1						
52714	rinsing/washing water containing cyanides		1						
52716	concentrates and semi-concentrates containing metal salt		1						
52720	rinsing/washing water containing metal salts		1						
52721	copper etch solutions		1						
52722	ferric salt solutions		1						

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
52723	photographic developer baths		1		2				
52724	inorganic coolant solutions		1						
52725	other concentrates, semi-concentrates, and rinsing and washing water		1						
53000	<i>wastes of plant-protective agents and pesticides as well as wastes from pharmaceutical products</i>								
53100	<i>wastes of plant-protective agents and pesticides</i>								
53103	old stocks and rests of plant-protective agents and pesticides				1			1	
53104	wastes plant-protective agents and pesticide production				1		2	1	
53300	<i>cosmetic waste</i>								
53302	waste from cosmetics production				1		2		
53500	<i>wastes from pharmaceutical products</i>								
53502	wastes from the production and processing of pharmaceutical products				1		2	1	
53507	disinfectants				1				
54000	<i>mineral oil wastes and coal upgrading products</i>								
54100	<i>mineral and synthetic oils</i>								
54104	contaminated fuels (petrols)		2		1				Special regulation acc. to § 5a, 5b AbfG
54106	transformer, heat transfer and hydraulic oils free of PCBs				1				Special regulation acc. to § 5a, 5b AbfG
54107	transformer, heat transfer and hydraulic oils containing PCBs				1				Special regulation acc. to § 5a, 5b AbfG
54108	contaminated heating oils (including diesel oil)		2		1				Special regulation acc. to § 5a, 5b AbfG

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
54109	drilling, cutting and grinding oils		1		1				Special regulation acc. to § 5a, 5b AbfG
54110	products and process materials containing PCBs				2			1	
54111	other wastes containing PCBs		2		1			1	
54112	combustion engine and transmission oils		2		1				Special regulation acc. to § 5a, 5b AbfG
54113	machine and turbine oils		2		1				Special regulation acc. to § 5a, 5b AbfG
54114	combustion engine, transmission, machine and turbine oils, containing polychlorated biphenyls and halogen containing polychlorated biphenyl substitutes; refrigerator oils from cooling equipment and air conditioning systems				1				Special regulation acc. to § 5a, 5b AbfG
<i>54200</i>	<i>fats and waxes from mineral oils</i>								
54201	slack waxes				1				
54202	fat wastes				1				
54204	fatty acid residues				1				
54206	metallic soaps				1		2	2	
54207	wax wastes								
54208	fatty acid derivatives				1				
54209	fat- and oil soiled process materials, solid			2	1				
<i>54400</i>	<i>mineral oil emulsions and mixtures</i>								
54401	synthetic coolants and lubricants		2		1				Special regulation acc. to § 5a, 5b AbfG
54402	drilling and grinding emulsions and emulsion mixtures		1		1				Special regulation acc. to § 5a, 5b AbfG

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
54404	honing oils		1		1				Special regulation acc. to § 5a, 5b AbfG
54405	compressor condensates		1		1				
54406	wax emulsions		1		1				
54407	tar emulsions				1				
54408	other oil-water mixtures		1		1				Special regulation acc. to § 5a, 5b AbfG
54700	<i>mineral oil sludges</i>								
54700	<i>mineral oil sludges</i>								
54701	sand filter residues		1		1	2			Special regulation acc. to § 5a, 5b AbfG
54702	oil and petrol separator residues		1		1				Special regulation acc. to § 5a, 5b AbfG
54703	sludge from oil separators		2		1	2	2		Special regulation acc. to § 5a, 5b AbfG
54704	sludge from tank and barrel cleaning		1		1				Special regulation acc. to § 5a, 5b AbfG
54705	pumice/oil mixtures				1				
54706	paraffin oil sludge				1				
54707	spark erosion sludge				1				
54708	honing and lapping sludges				1				
54710	grinding sludges containing oil				1		2		
54800	<i>residues from oil refining</i>								
54801	bleaching soil, containing mineral oils				1				
54802	acid resins and tars		1		1				
54803	sludge from lubricating oil refining				1				
54805	sulfur						1		Mono-landfill
54806	residues from acid-resin processing				1				

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
54807	acids containing mineral oil		1		1				
54808	aqueous residues from refining spent oil		1		2				Special regulation acc. to § 5a, 5b AbfG
<i>54900</i>	<i>wastes from processing mineral oil and coal</i>								
54903	sludge containing phenols				1				
54904	sludge containing mercaptan				1				
54905	solid residues containing anthracene				1		2		
54906	solid residues containing naphthalene				1		2		
54907	solid residues containing phenols				1		2		
54908	pellets from oil gasification				1		2		
54909	sludge from coking/gas plant wet scrubbers		1				1		
54910	pitch wastes				1				
54913	tar residues				1				
54915	distillation residues from tar oil production				1		2		
54918	phenol water				1				
54920	sludge from glycerine purification			2	1				
54923	sludge containing cyanides		1				2		
54924	other sludges from coking and gas works				1		1		
54925	other sludges from the petrochemical industry				1		1		
<i>55000</i>	<i>organic solvents, paints, varnishes, glues, putties and resins</i>								
<i>55200</i>	<i>halogenated organic solvents and solvent mixtures, other liquids with halogenated organic compounds</i>								
55201	1,2-dichloroethane				1				
55202	chlorobenzene				1				
55203	trichloromethane (chloroform)				1				

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
55205	fluorocarbons, coolants, propellants and solvents				1				
55206	dichloromethane				1				
55209	tetrachloroethene				1				
55211	tetrachloromethane				1				
55212	trichloroethane				1				
55213	trichloroethene (tri)				1				
55220	solvent mixtures, containing halogenated organic solvents				1				
55223	other halogenated organic solvents				1				
55224	solvent/water mixtures, containing halogenated organic solvents		1		1				
55300	<i>organic solvents and other organic liquids, free of halogenated organic compounds</i>								
55301	acetone and other aliphatic ketones				1				
55303	ethylene glycoles				1				
55306	benzene, toluene, xylenes				1				
55310	diethyl ether or other aliphatic ethers				1				
55311	dimethyl formamide				1				
55314	dioxane				1				
55315	methanol and other liquid alcohols				1				
55316	methyl acetate and other aliphatic acetate esters				1				
55321	carbon disulfide				1				
55322	tetrahydrofurane				1				
55326	washing petrol, petrol ether, ligroin, test petrol				1				Special regulation acc. to § 5a, 5b AbfG
55352	aliphatic amines				1				
55353	aromatic amines				1				
55356	glycol ether				1				
55357	cold cleaners, free of halogenated organic solvents				1				
55359	paint and varnish thinners (nitro thinners)				1				

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
55360	petroleum				1				Special regulation acc. to § 5a, 5b AbfG
55370	solvent mixtures, free of halogenated organic solvents				1				
55373	other non-halogenated organic solvents				1				
55374	solvent/water mixtures, free of halogenated organic solvents		1		1				
55400	<i>sludges and process materials containing solvents</i>								
55401	solvent-containing sludges with halogenated organic solvents		2		1				
55402	solvent-containing sludges, free of halogenated organic solvents		2		1				
55403	process materials containing halogenated organic solvents				1				
55404	process materials, free of halogenated organic solvents				1				
55500	<i>painting materials</i>								
55503	paint and varnish sludge			2	1				
55508	painting materials				1				
55509	printing ink residues				1				
55510	paint shop waste, non-solidified				1				
55512	old stocks of paints, non-solidified				1				
55514	paints (pigments and dyes), organic				1				
55515	paints (pigments and dyes), inorganic						1	1	
55900	<i>glues, putty, non-solidified resins</i>								
55903	resin residues, non-solidified				1				
55904	resin oil				1				
55905	glue and adhesives, non-solidified				1				
55907	putty and spackling putty, non-solidified				1				
57000	<i>plastic and rubber wastes</i>								

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
57100	<i>other solidified plastic wastes</i>								
57125	ion exchanger resins with noxious contaminants				1		1		
57127	plastic containers with noxious residues				1		1		
57200	<i>non-solidified plastic wastes, mould compounds and components</i>								
57201	plasticizers with halogenated organic components				1				
57202	residues from plastic production and processing				1				
57203	plasticizers free of halogenated organic components				1				
57300	<i>polymeric sludges and emulsions</i>								
57303	polymeric dispersions and emulsions		1		1				
57305	plastic sludges containing solvents (with halogenated organic solvents)		2		1				
57306	plastic sludges containing solvents (without halogenated organic solvents)		2		1				
57700	<i>rubber sludges and emulsions</i>								
57702	latex sludges and emulsions		2		1				
57704	rubber solutions				1				
57706	rubber sludges containing solvents				1				
57800	<i>shredder residues</i>								
57801	shredder residues (light fraction)	B			1	2	2		Mono-landfill
57802	filter dust from shredders					2	1		
58000	<i>textile wastes</i>								
58100	<i>wastes from textile production and processing</i>								
58115	sludge from fabric-dyeing plants				1		2		
58116	sludge from fabric finishing				1		1		
58118	laundry sludge				1		1		
58200	<i>soiled textiles</i>								

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
58201	filter cloths and sacks with noxious contaminants, mostly organic				1				
58202	filter cloths and sacks with noxious contaminants, mostly inorganic						1		
58203	textile containers with noxious contaminants, mainly organic				1				
58204	textile containers with noxious contaminants, mainly inorganic						1		
58205	polishing wool and felts with noxious contaminants				1		1		
59000	<i>other wastes from chemical conversion and synthesis products</i>								
59100	<i>explosives</i>								
59101	pyrotechnical wastes								Special treatment
59102	explosive wastes, ammunition wastes								Special treatment
59103	multiply nitrated organic chemicals								Special treatment
59300	<i>laboratory wastes and chemicals</i>								
59301	fine chemicals		1		1		2	1	
59302	waste lab chemicals, organic				1			2	
59303	waste lab chemicals, inorganic		1		2		2	1	
59304	chemically contaminated process materials		1		1		2	1	
59400	<i>detergent and soap wastes</i>								
59401	residues from detergent production				1		2		
59402	tensides				1				
59404	sulfonic acids and soaps				1				
59500	<i>catalysts</i>								
59507	spent catalysts and contacts		1		1	2	1	1	
59600	<i>premixed wastes destined for disposal facilities</i>								
59603	premixed wastes destined for incineration				1				

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative							
			CPB	HMV	SAV	HMD	SAD	UTD	Other	
59604	premixed wastes destined for deposition							1	1	
59700	<i>distillation residues</i>									
59702	distillation residues containing solvents (with halogenated organic solvents)					1				
59703	distillation residues containing solvents (without halogenated organic solvents)					1				
59705	inorganic distillation residues							2	1	Mono-landfill
59706	organic distillation residues					1		2		
59707	distillation residues from dry cleaners					1				
59800	<i>gases in containers</i>									
59801	gases in cartridges									Special treatment
59802	gases in steel cylinders									Special treatment
59900	<i>other wastes from conversion and synthesis processes</i>									
59901	polychlorated biphenyls (PCBs)					1			1	
59903	phenols					1				
59904	organic peroxides		1			1				
59905	inorganic peroxides		1							
59906	industrial sweepings			2		1	2	1		
59907	electrolysis cell scrap							1		
90000	MUNICIPAL WASTE (INCLUDING SIMILAR COMMERCIAL WASTE)									
94000	<i>waste from water treatment and sewage plants</i>									
94800	<i>sludges from industrial wastewater treatment</i>									
94801	sludges from industrial wastewater treatment					1		1		Mono-landfill
95000	<i>liquid waste from processing and disposal plants</i>									
95300	<i>leakage water from landfills</i>									
95301	leakage water from domestic waste landfills		1							

Waste code		Bulk waste	Remarks on disposal, if reuse/recycling assessment is negative						
			CPB	HMV	SAV	HMD	SAD	UTD	Other
95302	leakage water from hazardous waste landfills		1						
95303	leakage water from slag landfills		1						
95304	sedimentation water from sludge deposits and settling tanks		1						
95400	<i>liquid wastes from incineration plants and firing installations</i>								
95401	scrubbing water, process water		1						
95402	water from wet de-sludging		1						
95403	residues from boiler smoke scrubbers		1						
97000	<i>hospital specific wastes</i>								
97100	<i>hospital specific wastes</i>								
97101	infectious waste		1		1*				*Special regulation in preparation
97104	body parts and organ waste				1*				*Special regulation in preparation

Appendix D
Assignment Criteria

The following assignment values are to be complied with in waste assignment for aboveground storage:

No.	Parameter	Assignment value
D1 Consistency		
D1.01	Transverse resistance	≥ 25 kN/m ²
D1.02	Axial deformation	≤ 20 %
D1.03	Unconfined compression strength (flow value)	≥ 50 kN/m ²
D2	<i>Annealing loss of the dry residue of the original substance</i>	≤ 10 wt-%
D3	Extractable lipophilic substance	≤ 4 wt-%
D4 Eluate criteria		
D4.01	pH value	4 - 13
D4.02	Conductivity	≤ 100,000 μS/cm
D4.03	TOC	≤ 200 mg/l
D4.04	Phenols	≤ 100 mg/l
D4.05	Arsenic	≤ 1 mg/l
D4.06	Lead	≤ 2 mg/l
D4.07	Cadmium	≤ 0,5 mg/l
D4.08	Chromium-VI	≤ 0,5 mg/l
D4.09	Copper	≤ 10 mg/l
D4.10	Nickel	≤ 2 mg/l
D4.11	Mercury	≤ 0,1 mg/l
D4.12	Zinc	≤ 10 mg/l
D4.13	Fluoride	≤ 50 mg/l
D4.14	Ammonia	≤ 1,000 mg/l
D4.15	Chloride	≤ 10,000 mg/l
D4.16	Cyanide, easily released	≤ 1 mg/l
D4.17	Sulphate	≤ 5,000 mg/l
D4.18	Nitrite	≤ 30 mg/l
D4.19	AOX	≤ 3 mg/l
D4.20	Water-soluble portion	≤ 10 wt-%

Appendix E

Material and test requirements for the manufacture of landfill insulation systems

Appendix F

Comparison of leachate treatment processes

Appendix G

Measurement and monitoring programme for operator inspections of aboveground landfill

Appendix H

Suitability test for solidified waste materials

Not included in English translation