

# NEW RULES FOR UNDERGROUND WASTE DISPOSAL

The Ordinance on Underground Waste Stowage entered into force on 30 October 2002.

The Stowage Ordinance is another module within the strategy to promote high-grade waste disposal entailing no damage or harm. Subsequent to issuing the Commercial Wastes Ordinance, the Ordinance to Amend the Waste Oil Ordinance and the Waste Wood Ordinance, additional clear framework conditions are thus established for waste management. The Federal Government is acting on past experience which showed that the recommendations for waste stowage in mines which had, until issuance of the new Ordinance, not been legally binding, had often not been applied consistently. Legally binding rules are essential in the interest of ecology, as a basis for secure investment and as a prerequisite for fair competition.

## Initial Situation

In addition to slags and wastes occurring in the mining industry itself, specific mineral wastes occurring outside the mining sector are used underground as stowage materials at more than 20 sites. These materials include, for example, spent linings and refractories from furnaces, cinders, filter dusts, FDG gypsum, waste sands from foundries, contaminated soils and sludges. Stowage takes place in order to prevent fires and explosions, to upgrade ventilation, and to improve the stability of the rock and to reduce subsidence effects at surfaces. Stowage occurs both during operation and subsequent to an imposed order, after closing down. Stowage predominantly takes place in saline rock formations (in the *Länder* of Baden-Württemberg, Hessen, Saxony-Anhalt, Thuringia) and, in individual cases, in hard-coal and ore formations (North Rhine-Westphalia, Saarland).

Stowage materials are produced above ground on the basis of specific recipes subject to licensing and fed underground by means of various methods. Depending upon

local conditions, mechanical (dump stowage, centrifugal stowage, big bags), pneumatic or hydraulic (liquid stowage, water stowage, pump stowage) stowage methods are applied. In this process, wastes are used as direct or indirect building material required for the recipe or as mixing liquids. In terms of (building) physics, they are required to possess the properties needed for the envisaged use. For example, they may serve as binding agents, small aggregates or mineral fillers.

## **Quantities**

The total volume of stowed extraneous wastes, which amounted to 1.7m tonnes in 1994, remained almost unchanged until 1997. The proportion of hazardous wastes included in these volume figures amounted to 676,294 tonnes = 40% in 1997, as compared to 20% in 1994, which is approximately 7.5% of the entire volume of hazardous wastes produced in Germany. In 1998 and 1999, the upwards trend continued. A substantial proportion of the wastes stowed is imported, e.g. from Denmark, the Netherlands, Austria, Luxembourg, Italy, where underground disposal facilities do not exist. (see attached table)

Not only are wastes used at specific stowage sites but specific cements are also manufactured from them, to be used as building materials for arch sets in collieries, for dams running parallel to roads, for shaft filling or for cover constructions. The wastes used to produce such cement mainly consist in residues from coal-fired or lignite-fired power stations, sewage sludge incineration plants or waste incineration plants.

## **Need for Regulation**

In practice, alarming tendencies have prevailed both with regard to the wastes used and as far as the pollutant levels to be observed are concerned.

On the one hand, for example, residues from municipal and hazardous waste incineration containing large quantities of pollutants are used in mines where permanent enclosure of these substances from the biosphere is not ensured, as would be the case in dry saline rock formations. Therefore, mine water and groundwater may be affected by the wastes fed at these sites as soon as draining operations are stopped.

As compared to the requirements on hazardous waste disposal in underground landfills, this practice lacks requirements to protect the environment.

On the other hand, wastes are used as stowage materials with a metal content which may be reclaimed by means of metallurgical recycling methods and be re-fed to manufacturing processes. This particularly concerns filter dusts from the steel industry containing as much as 30% of zinc. This conflicts with the objectives contained in the Closed Substance Cycle and Waste Management Act, i.e. to save natural resources and aim at high-quality recycling appropriate for the type and nature of the waste in question.

## **Objectives of the Ordinance**

### Article 1 – Stowage Ordinance

On the one hand, the objective of the Stowage Ordinance is to exclude wastes containing metal which may be utilised for higher-value purposes from stowage insofar as it is possible to recycle them. Thus, the requirement pursuant to the third sentence of § 5, para. (2) of the Closed Substance Cycle and Waste Management Act to aim at high-quality recycling appropriate for the type and nature of the waste in question is explicitly expressed in binding legal terms. On the other hand, stowing wastes containing large quantities of pollutants is to be excluded at sites where such substances cannot permanently be enclosed from the biosphere in saline rock. For this purpose, requirements for substances pursuant to § 7, para. (2) of the Closed Substance Cycle and Waste Management Act made to stowage sites which are not located within saline rock and for which the permanent enclosure of wastes cannot be proved by furnishing long-term safety documentation, are defined with legally binding effect.

The use of wastes in underground constructions is regulated. The requirements apply to the direct use of wastes as stowage materials, to the production of stowage mixtures and mining cement whereby wastes are used. Underground facilities for the final disposal of radioactive wastes are exempted since such facilities are provided with proprietary comprehensive long-term safety concepts. The provisions are targeted at those producing or owning waste, mining companies and facilities for the

production of stowage materials. Carriers and operators of interim-storage facilities are also included.

### Metal Recycling as a Priority

§ 3 contains priority provisions in favour of recycling wastes containing metal as opposed to their use as stowage materials. In Appendix 1, limit values are listed for the following metals: zinc, lead, copper, tin, chromium, nickel and iron. If such a value is reached or exceeded, the metals contained in the waste are to be reclaimed insofar as this is technically possible and where this is economically viable, and insofar as this is feasible while observing the permissibility requirements.

### Physical Requirements for Wastes

§ 4 stipulates the fundamental rule that only wastes for which specific limit values are observed may be utilised to produce stowage materials and/or for direct use as stowage materials. On the one hand, solids limit values are established in Appendix 2 for each unmixed waste used as input material and/or directly used as stowage material. These values are identical to the Z 2 values contained in the "requirements for the material recycling of mineral residues/wastes" [*Anforderungen an die stoffliche Verwertung von mineralischen Reststoffen/Abfällen*] of LAGA [*Länderarbeitsgemeinschaft Abfall*] (Joint *Länder* Working Group on Waste] for the inclusion of waste minerals in noise barriers, as road foundations and as a base in road construction. In Appendix 2, on the other hand, strict requirements are made regarding stowage materials for the solid integration of possible pollutants in order to minimise detrition caused by mine and ground water; these criteria apply to both wastes directly used or stowage mixtures produced by adding wastes. These limit values are identical to the trigger values for assessing the soil – groundwater pathway pursuant to § 8, para. (1), second sentence, no. 1 of the Federal Soil Protection Act. In order to render these limit values enforceable, they are complemented by provisions pertaining to sampling and analytics contained in Appendix 3.

Furthermore, a limit is established for the organic contents of wastes used.

§ 4, para. (2) contains exemptions according to which unauthorised restrictions may be avoided. On the one hand, this applies to cases in which wastes would otherwise

be excluded from stowage although they do not exceed the geogenous basic contents of the absorbing rock. On the other hand, stowage materials are permitted in carbon insofar as only wastes from coal firing are used.

Except for the limit established with regard to organic contents, the limit values contained in § 4 do not usually apply to the use of stowage materials at sites located within saline rock for which proof has been furnished concerning the permanent enclosure of wastes from the biosphere by providing long-term safety documentation. The principle of permanent enclosure in saline rock is the key requirement made to underground landfills in the Landfill Ordinance. Where the level of safety at a stowage site is relatively high, no objective need to limit the pollutant potential is given because such pollutants are permanently enclosed from the biosphere.

For reasons concerning specifiedness and uniform implementation, Appendix 4 contains indications regarding the provision of long-term safety documentation. Thus, stowage mines must meet the same safety requirements as underground landfills.

#### Transitional Provisions

The requirements for wastes used for stowage may make it necessary for some mines to change their stowage concepts. The development processes required for this purpose, as well as the acquisition of different materials and respective licenses may take some time. Therefore, § 6 provides that in the event of stowage activities occurring on the grounds of licenses granted before entry into force of the Ordinance or on the grounds of disposal contracts entered into which are legally valid, the requirements under §§ 3, 4 and 5 are to be observed on expiry of such licenses or when such contracts are terminated, no later, however, than 1 March 2006. At the same time, producers of waste are also given sufficient time to change their disposal concepts.

### Disposal of non-mining residues/ wastes in underground excavations

	Land	1992	1994 of these RSD		1995 of these RSD			1996 of these RSD			
		Volume [t]	Volume [t]	Volume [t]	[%]	Volume [t]	Volume [t]	[%]	Volume [t]	Volume [t]	[%]
1	Baden-Württemberg	62,327	92,492	48,269	52	149,651	105,173	70	90,277	47,387	53
2	Brandenburg	62,000	213,138	0	-	112,249	0	-	44,255	0	-
3	Hesse	16,000	26,479	5,801	22	42,735	21,858	51	73,495	42,039	57
4	Lower Saxony	1,683	1,598	1,598	100	1,930	1,930	100	1,574	1,574	100
5	North Rhine-Westphalia	284,601	295,824	66,770	23	314,289	65,497	21	398,973	154,110	39
6	Saarland	104,000	239,895	48,000	20	264,791	4,401	2	264,739	34,081	13
7	Saxony	0	95,000	0	-	55,150	0	-	55,066	0	-
8	Saxony-Anhalt	117,966	66,862	63,036	94	229,761	136,004	59	265,560	122,977	46
9	Thuringia	596,656	689,862	115,323	17	305,636	61,262	29	350,178	101,344	29
	Total	1,245,233	1,721,150	348,797	20	1,476,192	396,125	27	1,544,117	503,512	33

	Land	Volume [t]	1997 of these RSD		1998 of these RSD			1999			
			Volume [t]	[%]	Volume [t]	Volume [t]	[%]	Volume [t]	WRRS [t]	WRS [t]	WNRS [t]
1	Baden-Württemberg	180,684	59,262	33	333,389	92,051	28	478,845	76,620	340,898	61,317
2	Brandenburg	82,432	0	-	150,119	0	-	137,590	0	0	137,590
3	Hesse	81,144	78,634	97	73,826	73,727	99,9	80,902	75,790	4,499	613
4	Lower Saxony	2,127	2,127	100	2,762	2,762	100	3,450	3,450	0	0
5	North Rhine-Westphalia	345,996	181,460	52	273,713	168,804	62	224,870	77,232	9,607	138,031
6	Saarland	295,852	52,288	18	173,063	(-)	(-)	188,484	(-)	(-)	(-)
7	Saxony	54,000	0	-	37,370	0	-	46,200	0	0	46,200
8	Saxony-Anhalt	299,328	126,291	42	365,812	210,845	58	360,860	138,083	74,874	147,903
9	Thuringia	362,280	176,232	49	521,384	327,904	63	594,140	303,988	58,800	231,352
	Total	1,703,843	676,294	40	1,931,438	*) 876,093		2,115,341	*)675163	*)488,678	*) 763,006

\*) Figures without the Saarland

**Note:** No wastes were disposed in the *Länder* of Bavaria, Berlin, Bremen, Hamburg, Mecklenburg-Western Pomerania, Rhineland-Palatinate and Schleswig-Holstein.  
In Lower Saxony wastes were disposed in a cavern - as special case disposal.  
**WRRS:** wastes requiring special supervision, **WRS:** wastes requiring supervision, **WNRS:** wastes not requiring supervision, **RSD:** requiring supervision in case of disposal