FILLING MIXTURES AND LEGISLATIVE ASPECTS OF THEIR APPLICATION FOR THE DISPOSAL OF MINE WORKINGS

ZÁKLADKOVÉ SMĚSI A LEGISLATIVNÍ ASPEKTY JEJICH POUŽÍVÁNÍ PRO LIKVIDACI DŮLNÍCH DĚL

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Abstract

The paper deals with the legislative aspects of the use of filling mixtures during the remediation of mining activities. The enterprises, carrying out the disposal of mine workings, buy filling mixtures within public procurement and need the quality of the products to be guaranteed. The requirements laid down in the technical guidelines for the certification of specified construction products raise doubts about the safety of products in terms of hygiene, protection of health and the environment. Currently, legislative development is underway in this area, striving for the implementation of the REACH Regulation into technical guidelines and thus to achieve the filling mixture to be produced and used in a safe manner.

Abstrakt

Příspěvek se zabývá legislativními aspekty používání základkových směsí při zahlazování následků hornické činnosti. Podniky, které provádějí likvidaci důlních děl, nakupují základkové směsi v režimu veřejných zakázek a potřebují záruku kvality výrobku. Požadavky zakotvené v technických návodech pro certifikaci stanovených stavebních výrobků vyvolávají pochybnosti o bezpečnosti výrobku z hlediska hygieny, ochrany zdraví a životního prostředí. V současné době probíhá v této oblasti legislativní vývoj, který směřuje k implementaci nařízení REACH do technických návodů a tím k dosažení cíle, aby se základkové směsi vyráběly a používaly bezpečným způsobem.

Key words: filling mixture, remediation of mining activities, technical guidelines, REACH Regulation

1 INTRODUCTION

The existence of mine workings has a significant impact on individual components of the environment in the long term. The major problem is a large number of old and abandoned mine workings, occurred from past mining operations and activities involving mining, which must be disposed under the applicable legislation in order not to become a risk in the future.

2 REMEDIATION OF MINING ACTIVITIES

The Czech Republic gives support to the coal industry for remediation of mining activities. The aid is compatible with proper functioning of the common market of the European Union. The funds are intended solely to cover inherited liabilities that arise in connection with the closure of coal mines. The Czech coal industry does not receive any grants for current coal mining operations. In this respect, the Czech Republic acts in accordance with Council Regulation (EC) No. 1407/2002 of 23 July 2002, on state aid to the coal industry.

In order to maintain the competitiveness of Czech private mining companies, an addressable system of providing state funds had to be created, exclusively for mining companies in decline that are owned by the state. Within the restructuring process of the coal mining industry in the Czech Republic, the sites, where mining had been completed, were separated from private mining companies.

The state enterprises that have adopted the subdued localities are provided with funds from the state budget for remediation of mining operations [1]. Thus addressing the consequences of ecological loads, incurred before the effective date of the amendment to Act No. 44/1988 Coll. on the protection and exploitation of mineral resources (Mining Act), was ensured in 1993. In that year, the Mining Act was amended by Act No. 168/1993 Coll. which imposes the obligation on mining companies to create reserve funds to ensure the settlement of mining damages.

The state enterprises DIAMO, s. p. and Palivový kombinát Ústí, s. p. (Fuel Combine) provide for the remediation of mining operations at two levels based on the resolution of the Government of the Czech Republic. On the one hand, they provide the disposal of mine workings, and on the other, the remediation and reclamation of the affected area. This is significant fact in terms of Act No. 100/2001 Coll., on environmental impact assessment and on amendments to certain related acts (Act on Environmental Impact Assessment).

Underground coal extraction becomes evident on the surface by two typical elements. These are rock (mine stone) dumps and subsidence due to undermining [2]. Uncontrolled outputs of mine gases, from which especially methane poses a threat to the environment, are concomitant phenomena of deep mining in OKR as well.

By nature of remediation and reclamation works, the remediation of mining damage on the surface subjects to the assessment under provisions of Article 4 of Act, Environmental Impact Assessment, according to Section 1.3 Water regulation, or other adjustments affecting drainage conditions on the area of 10-50 hectares, or in compliance with Section 2.10 Waste disposal, by depositing to natural or man-made rock structures and gaps, category II of Annex 1 of this Act [3].

The disposal of mine workings does not subject to the environment impact assessment of the project. The disposal of mine workings is performed by an organization under provisions of Act No. 61/1988 Coll., on mining activities, explosives and the State Mining Administration (Act on Mining Activities).

When the mine liquidation is prepared by an organization, a disposal plan for the mine working must be made in accordance with Article 32 (4) of Mining Act and Decree No. 104/1988 Coll., on efficient use of reserved deposits, on permits and notification of mining operations and activities involving mining. The application for the authorisation to safeguard or dispose mine workings must be submitted by the organization to the District Mining Office.

Mining companies may use mine waste for the disposal of their own mine workings being closed. The state-owned enterprises, which use state funds in the process of remediation of mining activities, shall procure needed services and materials for the mine disposal under provisions of Act No. 137/2006 Coll., on Public Contracts, as amended, as a certified product – a filling mixture. They need to guarantee the quality of the product in relation to the environment.

3 FILLING MIXTURES

In the submitted plan for the safeguard or disposal of mine, the method for securing mine workings must be specified. The organization is responsible for the correctness of the selected solution and shall demonstrate its expertise for mining operations. Therefore, the organization is also responsible for using the chosen filling mixture in compliance with the environmental legislation.

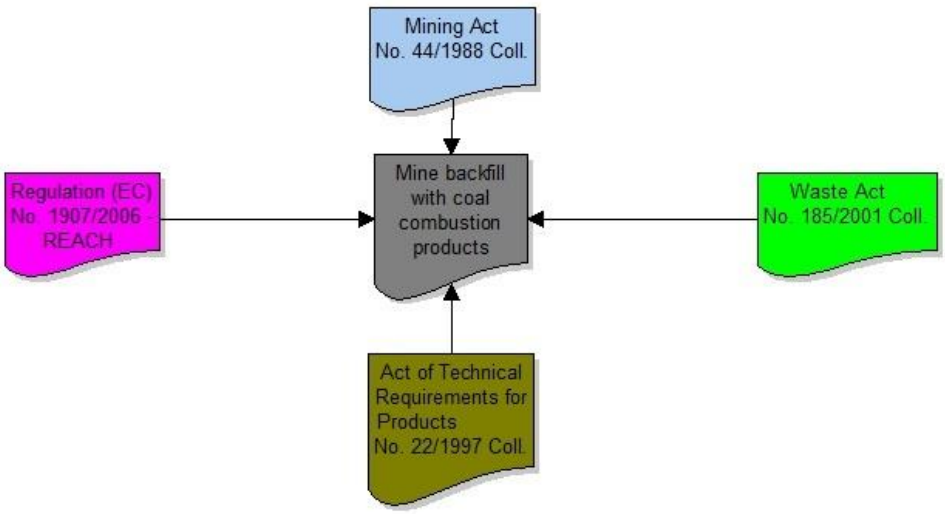

Fig. 1 Scheme of legal process control

In terms of mining legislation, the organization shall proceed in accordance with Decree No. 52/1997 Coll., on the requirements for health and safety at work and the safety of operations during the disposal of main mine workings. Provisions of Article 6 (1) impose: For the disposal of a main mine working, only non-flammable, insoluble, non-swellable and not turning slushy backfill materials can be used that may not pollute the environment with harmful vapours or leachates with toxic substances. In order to use another backfill material than natural stone, natural stone aggregates or secondary raw materials, the organization must request for the prior approval of competent environmental authorities [4]. Unfortunately, it is not clear which ones, as the decree refers to Article 4 of Act No. 238/1991 Coll., on waste, having been cancelled.

Fig. 2 Closing old mine (the photo taken by UNIGEO, a.s.)

These conditions are further substantially complicated when using a filling mixture made on the basis of energy by-products, until recently considered solely a waste. Manufacturers and users will thus get to a conflict with waste and product legislation requirements. The organization is suddenly required to be well informed

about its responsibilities imposed to the manufacturer of a filling mixture to comply with the requirements of responsible approach to the environment. These obligations must then be involved by the organization in terms and conditions for the safeguarding or disposal of a mine. The documentation submitted by the manufacturer of the filling mixture shall be then included in Annexes of the plan for safeguarding elaborated by the organization as part of the application for a mining permit to the extent specified in Article 6 of Decree No. 104/1988 Coll., as amended.

4 SPECIFIED PRODUCT CERTIFICATION

Filling mixtures are specified products under Act No. 22/1997 Coll., on Technical Requirements for Products. Therefore, before placing them on the market in the Czech Republic, they subject to mandatory conformity assessment and manufacturer's declaration of conformity according to the relevant Government Regulation.

In terms of conformity assessment, filling mixtures are by legislation included in the list of construction products which are assessed according to Government Regulation No. 163/2002 Coll., as amended by 312/2005 Coll. laying down technical requirements for selected construction products. They are included in Section 9 of Appendix 2 Special materials, products, structures and equipment under order No 13. The backfill material intended for disposal of main and old mine workings by backfilling operations. The certification under Article 5 of Government Regulation is a prescribed method for assessing the conformity of product [5, 6]. Such certificate or report of conformity assessment issued by an authorized person to the manufacturer for a specified product in relation to the requirements of Government Regulation No. 163/2002 Coll. forms the basis for issuing the declaration of conformity in accordance with Act No. 22/1997 Coll.

The identification of product properties of backfilling and filling materials must be provided by the manufacturer under Article 2 of Government Regulation No. 163/2002 Coll. through an authorized person. Based on these technical findings, the authorized person shall provide the manufacturer with the Building Technical Certificate with a limited duration for max 5 years, determining the technical characteristics of the product in relation to the basic requirements for the liquidation of mine, depending on the role the product has in the liquidation. This period may be extended by the authorized person.

5 REQUIRED PRODUCT PROPERTIES

Required characteristics, quality levels, end-use properties of materials intended for backfilling the mine workings being liquidated, are not fully identified in the defined standards. Therefore, the Technical Guidelines (TG) were elaborated which is a technical document prepared for construction products listed in Annex 2 to Government Regulation No. 163/2002 Coll. All authorized persons are obliged to follow the Technical Guidelines during the implementation of certification in accordance with the conditions for granting the authorization by the Office for Standards, Metrology and Testing (COSMT). The Technical Guidelines are constantly updated according to changes in the technical standardization and according to new knowledge in the field of science and technology [7]. Currently the following documents are valid for filling mixtures:

Name	**Number of Technical Guidelines**	**Date of Registration**
Backfill material intended for disposal of main and old mine workings by backfilling operations		
Consolidated backfill material – CBM	9. 13. 2001	1. 1. 2013
Unconsolidated backfill material – UBM	9. 13. 2002	1. 1. 2013

According to the Technical Guidelines, the UBM is rocky waste loose material from a grading, separating and washing treatment system of raw hard (black) coal composed of Carboniferous rocks – siltstones, sandstones and claystones. The CBM is, by a specific-recipe defined, optimal dense water composite slurry consisting of solid residues from the combustion of coal or solid residues from co-incineration (co-firing) of coal with biofuels.

Looking more closely at the Technical Guidelines, it can be found in which way one of the basic requirements is fulfilled, namely the requirement in terms of hygiene, health and the environment protection in accordance with Annex 1 to Government Regulation No. 163/2002 Coll., Article 3, letter (d), i.e. to prevent pollution of water or soil. This requirement is addressed by the reference to Decree No. 294/2005 Coll. of the

Ministry of the Environment, as amended, Annex 2, Article 1 and 2, i.e. only by specifying the sample treatment and analytical methods without links to the defined classes of leachability of wastes in Article 3. The material tested for certification will no longer be a waste, but it is interesting that limit values of the content of elements in water extract of the product given in the Technical Guidelines are higher for several monitored indicators (toxic metals) compared to the corresponding values of the Class I of leachability for landfilling the group S – inert waste. Similarly, it is also important that these limit values exceed the limits (for relevant indicators) of groundwater contamination according to the guidelines of the Ministry of the Environment „Contamination Indicators" established for making decisions on the necessity of rehabilitating interventions on sites affected by anthropogenic pollution. The guideline provides the values of indicators based on the values of the U.S. Environmental Protection Agency – USEPA valid in June 2011 [8]. Exceeding them should request further survey or removal of pollution.

Tab. 1 Comparison of the values of indicators imposed by individual regulations

Type of parameter	Indicator	Unit	Limit value Technical guidelines 09.13.01 19.13.02	Leachability of wastes - Class I Decree No. 294/2005 Coll.	Guideline by the Ministry of the Environment Indicators of pollution Ground water
Chemical elements in water extract	As[1)]	mg/l	**0.1**	0.05	0.000045
	Ba	mg/l	1.0	2	7.3
	Be	mg/l	0.005	/	0.073
	Pb	mg/l	**0.1**	0.05	0.01
	Cd	mg/l	0.005	0.004	0.018
	Cr_{total}	mg/l	**0.1**	0.05	/
	Co	mg/l	**0.1**	/	0.011
	Cu	mg/l	**1.0**	0.02	1.5
	Ni	mg/l	**0.1**	0.04	0.730
	Hg	mg/l	**0.005**	0.001	0.00063
	Se	mg/l	**0.05**	0.01	0.18
	Ag	mg/l	0.1	/	0.18
	V	mg/l	0.2	/	0.18
	Zn	mg/l	**3.0**	0.04	11

[1)] In case of arsenic in the Czech Republic, the concentrations higher than the mentioned above indicators of pollution are common due to geochemical conditions in the rock environment. In such cases, only arsenic concentrations exceeding natural background under site-specific conditions of the evaluated location represent the indication of pollution.

The values of indicators of pollution do not represent rehabilitation limits and should not be used as rehabilitation limits either [8]. However, the found out exceeding of the values of indicators is assessed as an indication of pollution that should be further studied and evaluated. If the filling mixture with its properties could negatively affect the environment, its use may be considered as handling harmful substances, i.e. operating activities pursuant to Act No. 167/2008 Coll., on the prevention and remedying of environmental damage and on amendments to certain Acts.

The risk of using products of coal combustion residues was assessed within the project SP/2f3/118/08 entitled "Investigation of real properties of waste that is considered a suitable source of non-standard raw materials (especially energy by-products) according to current legal requirements for public-health and environmental protection and the evaluation of the gained information for establishing safe procedures and requirements for their use". In the years 2008-2010, in addition to the researcher – Univerza-Středisko odpadů Praha, s.r.o., also the National Institute of Public Health (NIPH) in Prague and the Institute of Chemical Technology in Prague participated as co-organizations in the project. In conclusions, based on the obtained

objective information about the properties of energy by-products and based on the processing of model risk analyses, the researchers note that the release of products of coal combustion residues into an unprotected environment can cause damage to the environment [9].

It is clear that both products and wastes can contain toxic materials, and if not properly handled or controlled, they may pose a risk to human health or the environment. Additionally, industrial and mining wastes often have characteristics that in comparison with products may pose a risk to the environment. This relates to the fact that while the composition of products is generally specifically formed and controlled, the composition of wastes may be less apparent. That means that from an environmental point of view, it is extremely important the materials to be correctly classified as waste or non-waste substances [10].

6 REACH REGULATION REQUIREMENTS

Doubts arising from the conclusions of this study can be eliminated by a consistent application of the requirements of Regulation of the European Parliament and Council (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) to the certification of consolidated backfill materials. If wastes are used as materials and reusable substances and their mixtures are recovered from them, the newly acquired materials switch from the scope of waste legislation to the scope of REACH. The main responsibility the manufacturer shall have to fulfill under this Regulation is the obligation to register substances produced in quantities of 1 tonne or more per year.

The Technical Guidelines No 09/13/01 include the REACH Regulation in the list of technical regulations that apply to the product „Consolidated backfill material – CBM“. With regard the input materials, the Technical Guidelines No. 9.13.02 for UBM does not include any reference to the REACH Regulation.

The consolidated filling mixture consists of several substances. Every single substance, representing a component of the mixture, must be identified and registered in accordance with the REACH Regulation. The Substance Identity Profile (SIP) defines the requirements for the substance origin, its production process and chemical composition (a concentration range for each component). This is particularly important in the case of UVCB substances which also include ashes which are components of CBM. Only the substance, meeting the parameters defined in the SIP, can be registered.

A manufacturer of filling mixtures is a so-called downstream user, thus a user of chemicals who is not directly required to register substances, but the registration process concerns even him, especially in the case of cooperation in setting up so-called exposure scenarios for substances, defining the allowed use of a substance.

Part of the documentation of a registered substance is a chemical safety report. The chemical safety report shall be completed for all substances that subject to the registration under the REACH Regulation in quantities of 10 tonnes or more per year per registrant. A downstream user of the very substance or the substance included in a preparation shall prepare a chemical safety report for any use outside the conditions described in the exposure scenario or in the category of use and exposure submitted to him in a safety data sheet or for any use not recommended by its supplier, except the cases referred to in Article 37 (4) of the REACH Regulation [11].

The chemical safety report contains the information on risk management measures, information on substance properties, the assessment of hazard to human health and the environment, assessment of exposure, and risk characterization [12]. The certificate issued in accordance with the requirements of the valid Technical Guidelines No. 09.13.01, accompanied by the documentation of the registered substance, is a guarantee for the organization that the use of such certified filling mixture is in accordance with a responsible approach to the environment.

7 CONCLUSIONS

The REACH Regulation, which came into effect five years ago, supports the objective of protecting health and the environment. Provisions of the regulation are underpinned by the precautionary principle. Its implementation in the area of certification of backfill materials is gradually applied, although expert opinions on the scope of the REACH Regulation for specified construction products are not uniform.

So far the legislation for integrated pollution prevention and control (IPPC) in the Czech Republic allows to operate plants for recovery of hazardous wastes and produce filling mixtures from them, although it is excluded by the relevant technical guidelines.

The legislation concerning products and other legal regulations, such as the REACH Regulation, are intended for the protection of human health and the environment from potential environmental impacts of products and other materials not considered wastes. If this tool is consistently applied in the legislation on reserved construction products, the certification system will ensure the filling mixtures to be produced and used

in a safe manner. Besides the Czech Trade Inspection (CTI), controlling whether the properties of the specified products placed on the market comply with the relevant technical requirements or not, the Czech Environmental Inspectorate (CEI) will control the compliance with the obligation of registration, because without the registration number, chemicals cannot be marketed.

A state-owned company that will buy filling mixtures will be confident when strictly applying this legislation that the performed disposal of mine working will not jeopardize the quality of groundwater and does not become a danger for the future.

The principles and legal regulations for the disposal of mine workings and remediation of mining operations, of course, applies also to ore districts and private companies dealing with this issue in the Czech Republic.

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RESUMÉ

Pozůstatky hlubinné těžby uhlí jsou závažným problémem. Zahlazování následků bývalé hornické činnosti je hrazeno ze státních prostředků státním podnikům, které nakupují potřebný materiál a služby v režimu veřejných zakázek. Tato náprava realizací hornické činnosti nepodléhá posuzování vlivů záměru na životní prostředí. Likvidace dolu je povolována podle báňských předpisů. Za správnost zvoleného řešení odpovídá organizace, která prokazuje pro hornickou činnost odbornou způsobilost. Při likvidaci dolu používané základkové směsi jsou tedy posouzeny z hlediska jejich možného vlivu na horninové prostředí a podzemní vody pouze postupem certifikace stanoveného stavebního výrobku. Podmínky certifikace se komplikují při využití základkové směsi, vyrobené na bázi vedlejších energetických produktů. Zatím umožňuje legislativa pro integrovanou prevenci a omezování znečištění i využívání ostatních a nebezpečných odpadů. Výrobce i uživatelé se dostanou do oblasti střetu odpadové a výrobkové legislativy. Článek je zaměřen na hodnocení přínosu implementace evropské legislativy chemických látek – nařízení REACH do technických návodů, dojde tak z hlediska působnosti k rozšíření kontroly vlastností stanovených výrobků kromě ČOI i ze strany ČIŽP.