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ANALYSIS OF ENVIRONMENTAL EFFECTS OF INTENTIONS WITHIN DOMAIN OF SURFACE MINING ACTIVITY

Summary. In the Czech Republic where the process of environmental impact assessment has proceeded virtually since February 1993 the intentions for many domains have been assessed. The paper summarizes up author's experience with the environmental impact assessment process in the branch of surface mining of raw materials. The first case study is from branch smaller plans – extraction of stone and sand. The paper deals hereafter with impacts of mining of brown coal (large plans) on environment. The assessment of environmental impacts of brown coal mine will be demonstrated in assessing of effects of one of the biggest brown coal mine in the Czech Republic, which is situated in northern part of Bohemia.

ANALIZA ŚRODOWISKOWYCH EFEKTÓW PRZEDSIĘWZIĘĆ ZWIĄZANYCH Z DZIAŁALNOŚCIĄ GÓRNICTWA ODKRYWKOWEGO

Streszczenie. W Republice Czeskiej procedury oszacowywania wpływu na środowisko różnych dziedzin gospodarowania funkcjonują już od 1993 roku. Artykuł przedstawia doświadczenia autorów związane z określaniem wpływu działalności górniczej na środowisko. Zaprezentowano przykłady związane z eksploatacją kamienia budowlanego, piasku oraz węgla brunatnego. Określenie oddziaływania górnictwa węgla brunatnego przedstawiono na przykładzie jednej z największych kopalń w północnych Czechach.

1. Introduction

In Czech Republic where a process of environmental impact assessment has proceeded virtually since February 1993 intentions concerning many domains have been assessed. They are dealing above all with construction of transport infrastructure (highways, high speed motorways, railway lines, airports), industrial premises (automobile production industry,

chemical industry, textile industry, metallurgical plants), mining of mineral raw materials (hard or brown coal mines, extraction of stone and sand), construction within domain of waste management (landfills, decontamination areas, assorting lines, facilities for storage of hazardous waste or for processing of car wrecks, commercial and store centres and agricultural premises.

2. Act N° 100/2001 Coll. in relation to mining activity

Among the intentions concerning the domain of mining activities which have to be always assessed according to Act N° 100/2001 Coll. (the Czech Act on environmental impact assessment), in its applicable wording or are subject to fact-finding procedure rank the following ones:

In category I (plans, which are always subject to assessment):

- Extraction of black coal - new mining space or change in existing space (ME, i.e. the intention within competence of Ministry of the Environment of the Czech Republic),
- Extraction of black coal - new mining space or change in existing space (ME). Note: It does not concern a deposit where no mining area has been specified),
- Treatment of black and brown coal - batch exceeding 3 mil. ton p.a. (RA – i.e. the intention within competence of regional authorities),
- Uranium - excavation (including changes in and termination of mining) and treatment of uranium ores (chemical treatment and other technology, sludge beds and sludge fields) - ME competence,
- Plants for mining of asbestos ore and production of asbestos-containing products with annual capacity exceeding 10 tons p.a. of final products (ME),
- Extraction of petroleum in an amount exceeding 50 t/day and natural gas in an amount exceeding 50 000 m³/day (ME).

In category II (plans requiring fact-finding procedures):

- Coal - deep mining over 100 000 tons p.a. - if the impacts extend beyond the approved mining space (within Ministry of the Environment competence - ME). Note: This point can be applied very frequently, as it could be assumed in most cases that impacts would be demonstrated within approved mining area (e.g. heaving or sinking of water stream channels, effects on surface or on ground water, or eventually on aquifers, on action of

exhaust shafts and naturally in most cases all subsidence problematics would be „concerned“,

- Coal - deep mining over 100 000 tons p.a. - if the impacts extend beyond the approved mining space (within regional authorities competence - RA),
- Extraction and treatment of ores including sludge beds, sludge fields, tips and dumps (chemical, biological and other technology) – ME,
- Increase in surface extraction of mineral resources over 1 000 000 tons p.a. (ME),
- Extraction of mineral resources between 10 00 and 1 000 000 tons p.a. (RA),
- Extraction in river beds or valley banks of water streams (RA),
- Processing of black and brown coal - batches of 1 to 3 mil. tons p.a. (RA),
- Sludge beds, sludge fields, tips and dumps associated with treatment of mineral resources (RA).

Note: In addition to the above-mentioned the following two points can be considered:

- Construction projects, activities or technologies which have not been mentioned by the preceding points and which do not reach their parameters , but which can affect in a significant extent the state of life environment in territories protected in compliance with special legal regulations or by a special legal regulation.
- Permanent or temporary deforestation of areas of 5 ha to 25 ha extent – RA. At certain conditions – existence of wood growth and of given acreage – this point could be taken taken into consideration.

The intentions concerning mining activities which are being assessed at present in Czech Republic can be structured into two groups. The first group consists of minor intentions of extracting of sand and stone materials and the second group is represented by big extent intentions. Mostly an expansion of brown coal production by an opencast quarry or by an underground mine is concerned.

3. Analysis of environmental effects of intentions within domain of surface mining activity

When assessing the environmental effects of intentions of opencast brown coal mining it is necessary to take into consideration in particular the following factors:

1. sequestering of land,
2. effects on surface and ground water and on soil,

3. noise effects,
4. impacts on landscape character,
5. emission – fall-out situation.

Sequestering of land

For extraction of sand with annual output of about 30,000 m³ p.a. and a mean service life of deposit of 20 years it is necessary to anticipate a long-term temporary sequestration of land of about 60 thousand m² area, i.e. about 6 hectares. In case of major intentions of extracting of brown coal it is concerned a long-term sequestration of land of even hundreds of hectares area.

In view of the reality that extraction of sand is being proposed in all territories of Czech Republic including the most fertile ones, even the lands of Ist and of IInd class of soil protection, used to be temporarily sequestered. In case of major intentions of brown coal mining mostly sequestering of lands of inferior class of soil protection is concerned.

It is necessary to strip the upper layer of culture soil over total area concerned, to deposit separately the stripped soil on a convenient plot and to apply it for reclamation purposes (such is the practice mostly in case of minor intentions – when extracting sand or stone materials) or to use it according to requirements of agricultural land fund protection agency. The prerequisites of reclamation plan are specified by the decree N° 13/1994 Coll.

When extracting sand beds of mostly up to 20 m thickness temporary depressions in ground relief occur which have to be filled after termination of intention by reclamation material up to the original level line. In extensive big intentions of brown coal mining a reclamation is solved nowadays mostly by forestry reclamation, or eventually by forming of water reservoirs.

The reclamation of a surface mine working and of its immediate surroundings has to be accomplished in compliance with a rehabilitation and reclamation plan, which must be approved by environmental protection agency.

Impacts on surface and ground water and on soil

When extracting sand materials the groundwater table in most cases is not affected. By such intention neither the quantity nor the quality of water sources used for public and individual water management are endangered. In general the quality level of ground and surface water in close surroundings of sand extraction site would not be changed. However the level of groundwater is often affected by opencast mining of coal. Due to such coal extraction an increase of mineral substances content in ground water occurs (especially

sulphide minerals are concerned). Mine water of opencast coal mining is featured by low value of pH factor, high water hardness, high content of ferrous ions, high concentration of solved and suspended substances and by extraordinary low content of organic substances. It is necessary to clarify such mine water.

Rain water from unconsolidated surfaces is soaked up by ground. By a mining intervention the infiltration of rain precipitation up to groundwater table is accelerated. Consolidated surfaces for pumping fuel from petrol truck into mining mechanisms must be built up as impermeable ones, while in case of pumping fuel into tanks of mechanisms located within quarry pit the filling site must be underlaid by a retention tank with adsorption mat.

During opencast coal mining in a surface quarry industrial waste water occurs. There is waste water from oiled water treatment plant (from washing of locomotives), waste water from a slurry water treatment plant (i.e. from mud-settling ponds or eventually from coal crushing plants) and waste water from cleaning shops of wheel or crawler track equipment (mostly recycling cleaning shops are concerned). During extraction of sand such kinds of industrial waste water are not produced in general.

In course of extraction of sand it is not necessary to produce any sewage water. For needs of a single or two operators of sand extraction equipment as well as of drivers of customer trucks it is possible to install a mobile chemical toilet. In major intentions of brown coal mining it is necessary due to big number of employees to solve the sewage waste water problematics in an adequate way (by use of waste water treatment plant).

The proper mining technology process does not cause any big intensity pollution of soil. It should be taken into consideration only a local pollution of soil in case of emergency leakage of oil substances from mining and transport systems. However, removal of worked coal seam, or eventually of sand and adjacent rocks (of roof or intermediate strata) from mine working area, would provoke irreversible changes of rock environment.

Noise

The impact of noise can be assessed from two points of view – on the one hand as transport noise (travelling of vehicles along communications of the territory of interest outside of mining area) and on the other hand as noise of technology operation (noise propagated from mining area).

In minor intentions of sand extracting the noise of transport operation predominates, the level of technology noise being usually low (only a single or two excavators submersed in quarry pit are in operation). In major intentions of brown coal mining there is a reverse

situation – the noise of transport operation does not influence conspicuously the adjacent communications (the more so as railway transport is mostly used for haulage of coal), but the technology noise propagated from mining area is rather conspicuous. This noise can be controlled in both cases by a realisation of protective barriers, or eventually of protective forest zones.

Impact on landscape character

The term „landscape character“ has been introduced into practice by Act N° 114/1992 Sb. on protection of nature and landscape. The landscape is defined by it as natural, cultural and historical characteristics of a given locality or region. The landscape character should be protected against activities degrading its aesthetic and natural worth. The interventions into landscape character, especially location and permission of construction projects, can be performed only with regard to preservation of significant landscape elements, especially of protected territories, of dominant culture sights, of harmonic scale and co-relations within landscape. As the most important issue within frame of assessment of landscape character the preservation of such co-relations in landscape is to be considered. They are featured above all by transmissibility of landscape for various organisms.

It results from the above-mentioned facts that the opencast mining intentions are immediately as a rule a disturbing element within landscape which has a substantially negative impact on life environment. In minor sand extraction intentions it is possible after termination of exploitation to achieve by means of subsequent forestry or agricultural reclamation a restoration to original state. A more complicated situation is in case of residual pits of big opencast coal mining quarries where reclamation is generally a problem of many years after termination of mining activity. Frequently, in addition to forestry and agricultural reclamation, it is recommended as an optimum variant to apply hydric reclamation of a great part of residual pit. However, filling of such a lake with water can take sometimes even several years (e.g. 4-6 years) and it depends fully on abundance of next proper water stream. The filling of residual pits with water could bring also other complications. At a gradual ascending of water level during filling of lake slope deformations could occur due to progressive water saturation of slopes of internal tips (when loose soil materials have been applied) and thus it is necessary to take carefully into consideration all the connected geotechnical risks of this reclamation method.

Emission – fall-out study

For assessment of fall-out load of the territory of interest it is necessary to elaborate a scattering study by which mostly the impact of solid pollution substances such as sulfur dioxide, nitrogen oxides, carbon monoxide and benzene on environs of the assessed intention is evaluated.

In both types of intentions being assessed here it is necessary to carry-out sprinkling of operational communications and of soil on tips and to adhere to time schedule of reclamation plan so that by a gradually increasing share of green the negative impact of quarry on its environs and especially the risk of air pollution by fly ash would be reduced. It is necessary to observe and to safeguard continuously a functional condition of green on protective barriers.

In case of opencast coal mining it is necessary to check up by occasional measurement the accumulation of noxious substances in bottom zone of coal mining quarry at various meteorological situations and to assess the possibility of transporting of increased emissions to surrounding environs of the quarry. Furthermore, it is necessary to adhere to corresponding technology procedure when eliminating and liquidating spontaneous endogenic or exogenic coal fires.

When assessing the effects of intentions within frame of opencast mining activities on life environment it is equally necessary to take into consideration the following factors:

- impact on health of inhabitants,
- impact on flora and fauna,
- impact on archaeological relics,
- impact on transport infrastructure etc.

4. Conclusion

It is obvious from the above-mentioned text that the environmental impact assessment process is very important, because it enables in advance to reduce negative impacts of surface mining activities on environment. At the same time it makes possible to outline future environmental development of relatively big localities concerning especially surface mining of brown coal.

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