

DEVELOPING ENVIRONMENTAL CONCEPTS FOR VIETNAMESE COAL MINES

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Abstract

The main environmental issues in Vietnam's coal mining region Quang Ninh are the following: the water resources are polluted by mine waste waters, surface flow and seepage waters from the waste rock dumps. Acid mine drainage leads to low pH and high iron concentrations in the receiving waters. The waste rock dumps are piled high with steep slopes. The resulting stability problems inhibit recultivation measures. Landslides and dust erosion strongly affect air and water quality. Dust is additionally emitted from the various mining and processing sites and due to coal and waste rock transport by trucks. Many of the environmental issues due to mining are created by a serious lack of available space and growing landuse conflicts. As the mining sites are close to the coast the environmental impacts are crucial for Ha Long bay.

The Research Association Mining and Environment (RAME) was formed in 2005 in order to analyse the environmental impacts and their sources in Quang Ninh and to develop environmental concepts. The concepts include technologies, management and organization, implementation and control, awareness building, capacity building etc. The paper gives an overview on the environmental issues in Quang Ninh and solution approaches developed by RAME.

1. Introduction

The province Quang Ninh provides about 95% of the total hardcoal production of Vietnam. It is the most important hardcoal mining area in Vietnam. Moreover, the province shows exemplary the landuse conflicts between industry, settlements, tourism and the natural resources where the available space is very limited. Quang Ninh is an important industrial area due to its location near the coal reserves and near to the border. And the province is one of the most famous tourism centers of Vietnam, because of the limestone islands of Ha Long bay. The bay developed recently into a tourism center for both domestic and international tourists. Already in 1994 it was recognized as a world natural heritage by UNESCO.

2. Purpose

Near the coast the main landuses are tourism, other industry and settlements.

The coal mining areas are located in the hinterland but not very far away from the coastal areas. There are many areas where settlements and mining areas are very close to each other. This makes environmental measures in the coal mines even more necessary. For the tourism areas especially the effects on landscape due to mining activities are crucial. By reclaiming new land from the sea the province tries to provide more areas for living and for tourism facilities. But the reclaimed areas on the other hand pose a threat for the natural resources of Ha Long bay. To find an environmental sustainable balance between all the landuse requirements regional environmental planning is necessary.

3. Methodology

In the hardcoal mining region of Quang Ninh there are three mining areas: Dong Trieu / Uong Bi in the west, Hon Gai near Ha Long City and Cam Pha in the east. All three areas consist of mine sites of different sizes. The mining activities in Quang Ninh are organized under VINACOMIN group, but in fact there are many different and heterogeneous mine locations.

The everyday tasks in the field of environmental protection are various. Some examples are:

- Waste dump management including geotechnical stabilization, safety measures during the rainy season and in case of storms, recultivation measures,

- Water management in the mines, especially treatment of the waste water coming from mines and pits, drainage and treatment of the waters running off the waste rock dumps, constructions in rivers, protection and cleaning measures for lakes,

- Measures for dust mitigation inside and outside the mine areas, especially in settlement areas which are close to the mines,

- Monitoring of waste water, water quality, air quality and noise etc.

- In the last few years VINACOMIN has invested into smaller and bigger environmental measures. Some examples for measures are:

- Redesign and reshaping of waste rock dump surfaces,

- Planting of trees on waste rock dump areas with a small slope,

- Spraying systems for the reduction of dust emissions from the coal preparation plant, usage of water spraying trucks for the reduction of dust emissions along the main transport lines and in the open pits,

- Repair of transport systems, i. e. roads,

- Coal transport by train instead of the road,

- Construction measures in rivers, regular cleaning of river beds,

- Construction of sedimentation basins in waste water streams and rivers in order to keep the fine coal sediments upstream,
- Construction of dams and drainages at waste rock dump sites
- Etc.

Environmental projects currently in preparation are projects for mine water treatment, stabilization and recultivation of waste rock dumps and for the reduction of dust emissions along the coal transport routes.

The mining activities cause quite strong damages for the environment. The project "Mining and Environment in Vietnam" which is funded by BMBF develops concepts which reduce or prevent the environmental effects due to mining.

The water resources, i. e. ground water, surface water and sea water are affected by waste waters coming from the mines. The main pollution sources are:

- Mine waters from open pits and underground mines,
- Waste waters from coal screening and processing,
- Waste waters from the sanitary facilities at the mines and
- Surface runoffs and seepage waters from waste rock and coal dumps.

The main research task is to adapt the waste water treatment technologies to the conditions in Vietnam. The waste waters have different qualities, sometimes also mixed with sanitary waste waters. The waste water rates vary depending on the season. The rates after a heavy rainfall in the rainy season can be 3 to 5 times higher than the average rates during dry season. The region at some locations is characterized by narrow valleys, high slopes and small space available for constructions. That's why extreme space-saving technologies have to be developed.

The quality of the mine waters depends on the geological conditions surrounding the coal seams. The treatment technologies have to focus on pH, iron and manganese as well as on other heavy metals. Depending on the geology the values strongly vary between the mines. Furthermore, there are often surface runoffs from the operational areas, from roads, from storage areas or from waste rock dumps and sanitary waste waters from other facilities like bathrooms and kitchens.

Different solution approaches discuss the separated and the combined treatment of mine waters and sanitary waste waters. The treatment technology needs to react very flexible in case of varying waste water qualities and quantities. The treatment plant is optimized by comparing with the results from the experiments in a small-sized laboratory plant.

Waste rock dumps are another serious environmental problem in Quang Ninh. Due to the limited space available they are very high and with steep slopes. There is no technical compression of the waste rock material after dumping. Hence, many stability problems occur and the recultivation, especially on the slopes, is

quite difficult. In the result there are many landslides occurring, dust emission and strong erosion which leads to an input of sediments into surface waters and the coastal areas of Ha Long bay.

Due to the different morphology in the mining areas the dumps in Quang Ninh are not constructed layer by layer from bottom to top. This method also would include a compression of the material. The currently used method is the dumping from the top of a hill to the side. Hence, the material is not compressed, large particles are near the bottom, small particles are near the top. In general, the material in the dumps is very heterogeneous with particle sizes varying from dust to big rocks. Furthermore, some dumps were created on former old dumps. In those cases it is very difficult to get information about the ground below the dump. Within the project deep drillings will be necessary in order to get information about the internal structure of the dumps.

The main conditions for waste rock dumps in this region are:

- Limited space available,
- Climate conditions with dry and rainy seasons, heavy rainfall events, high temperatures and high humidity,
- Contents of the waste rock materials (partially it shows very high coal contents).

The climate in this region has the advantage that any successful recultivation process will happen faster than in Europe. But on the other hand the climate also includes extreme weather situations which cause problems for the waste rock dumps.

By using field experiments and computer models of the waste rock dump the most economic combination of stabilization technologies will be found. It also should fulfill the condition that the volume of waste rock material which has to be moved is as small as possible. Simultaneously, experiments for re-soiling are carried out by using different substrates. The plants growing on old dump sites are recorded in order to choose suitable plants for the recultivation.

Dust emission from the mining areas is a big problem in this region. Many processes during the coal mining and coal processing cause dust emissions: drilling, blasting, coal processing and of course the coal transport by truck. Areas without vegetation like for instance the waste rock dumps are dust sources as well. Additional dust is emitted each time a truck dumps material to the dump.

It is intended to develop a combination of planning and technical measures to achieve a sufficient reduction of dust emissions in the mining areas.

In the end there is not only the technical task to solve the individual problems mentioned above. There is also the necessity to build up a suitable environmental monitoring and the corresponding environmental information system. This is the basis for developing better environmental planning methods and instruments for the mining industry. Further steps are an environmental management system for the whole company and a foresighted regional and environmental planning which includes a suitable recycling of areas after the original landuse has been finished.

4. Conclusion

The environmental tasks in the coal mining areas of Quang Ninh are various due to the mining activities influence all environmental media at the same time. Additionally, the conditions in Quang Ninh are even more difficult because of severe landuse conflicts and small space available. That's why the research project introduced here works on all problems related to environment in this area. The overall objective is to combine the technologies into a sound environmental management for this region.

CÁC KHÁI NIỆM MÔI TRƯỜNG PHÁT TRIỂN ĐỐI VỚI CÁC MỎ THAN VIỆT NAM

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Từ khóa: Khai thác than, quản lý môi trường, nước thải, đất đá phế thải, bụi.

Tóm tắt

Các vấn đề môi trường chính trong ngành khai thác than của Việt Nam tại khu vực tỉnh Quảng Ninh là: Các nguồn nước bị ô nhiễm bởi nước thải của mỏ than, các dòng chảy bề mặt và nước rò rỉ từ các bãi đất đá thải; Hiện tượng pH nhỏ và nồng độ sắt tăng cao xuất hiện ở các nguồn nước bị ô nhiễm bởi nước thải axit của mỏ than; Các khu vực bãi thải đất đá thường được chất đống với các sườn dốc. Các hậu quả của những vấn đề nêu trên hạn chế các phương thức tái canh tác. Trượt lở và bụi xói mòn ảnh hưởng nghiêm trọng đến chất lượng nước và không khí. Thêm vào đó, bụi bản được sản sinh từ các khu mỏ và khu chế biến khác nhau, từ các hoạt động vận chuyển than và đất đá thải bằng xe tải. Rất nhiều vấn đề môi trường do hoạt động khai thác mỏ bị gây ra bởi sự thiếu trầm trọng các khoảng không hợp lý và sự xung đột cơ cấu sử dụng đất ngày càng tăng. Nhưng ảnh hưởng môi trường đối với Vịnh Hạ Long ngày càng nghiêm trọng khi các mỏ than đều nằm gần bờ biển.

Liên hiệp nghiên cứu Mỏ và Môi trường (RAME) được thành lập năm 2005 với yêu cầu nhằm phân tích các ảnh hưởng môi trường và các nguồn ảnh hưởng của chúng tại Tỉnh Quảng Ninh, đồng thời phát triển các khái niệm môi trường. Những khái niệm bao gồm công nghệ, quản lý và tổ chức, thi hành và điều khiển, nhận thức và năng lực... Bài báo đưa ra thông tin tổng quát về các vấn đề môi trường ở Tỉnh Quảng Ninh và những giải pháp tiếp cận của RAME.