

# POLICIES AND ADVANCES OF MINE LAND RECLAMATION IN CHINA<sup>1</sup>

By

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**Abstract.** China has a large amount of cultivatable land, but the average per person is very limited and only equals to one third of the world average. Every year, 20,000 to 30,000 hectares of land are lost because of mining, digging and piling on land for industrial purposes. This situation leads to severe land shortage and environmental pollution. Therefore, the problem has attracted great attention in China. "The Law of Land Administration," "The Law of Environmental Protection of PRC" and "The Stipulations of Land Reclamation" were enacted by the State Council of PRC in 1986, 1989, 1989 respectively. Some key policies and rules related to mine reclamation in these regulations are introduced in this paper. This paper also summarizes the advances in mine reclamation technologies in the last several decades in China. Based on the Chinese national situation, mine reclamation in China can be divided into three reclamation levels: farmland reclamation, local comprehensive renovation and regional reclamation planning. The processes and techniques of all the three reclamation levels were described in the paper with some case studies of several Chinese mine areas.

**Additional Keywords:** Reclamation of land, Mine subsidence, China, Policy and regulations, Environmental Problems, Reclamation planning

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## Introduction

China has a large amount of cultivatable land. According to the statistical data offered by the United Nations in 1986, the mean of cultivatable and permanent farmland per person in China only equals about 1/3 of the average value in the world, ranking 67th in the world. Among the lands to be developed

in China, the cultivatable land is only 34 million hectares. Thus, the cultivatable land shortage is very serious in China. Furthermore, China loses a large amount of land every year during its modernization construction. Along with the development of the construction, two million hectares of cultivatable land has been lost because of digging, mining and piling on land for industrial purposes. During the last several years, the land loss was 20,000 to 30,000 hectares per year. A average land loss of 40,000 hectares in 2000 is predicted.

Among these land loss, the loss caused by mining is an important part. In some Chinese mining areas, it is reported that 0.4 hectares of cultivatable land will be damaged when 10,000 tons of coal is mined.

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### Politics Related To Mine Reclamation

The shortage and damage of cultivatable lands has been paid great attention by Chinese people and government recently. "Highly valuing and reasonably utilizing every centimeter of land" has been stipulated as one of Chinese basic national policies. In 1986, China Government enacted "The law of land administration of PRC," which provides that the land utilized for industrial purposes must be severely limited, the damaged land must be reclaimed. In 1989, "The law of environmental protection of PRC" was put into effect, which provides prevention of land from erosion and damage in order to protect the Chinese environment. Following these two laws, every province, county and mining area established environmental protection and land administrative organizations. Based on the law of environmental protection, China practices the environmental impact evaluation institution and so-called "three-meantime" principle. The environmental impact evaluation

institution provides that for each construction, the construction unit must work out an environmental impact report based on the feasibility report. Only when the environmental impact report is agreed upon by the relative environmental administrative organ, can the construction unit be given national construction funds and begin to design and to build. The three meantime principle means that builders and producers must design, construct and go into operation in the meantime the principal engineering does.

The mining subsidence always causes huge losses not only in finance, but also in cultivatable lands, which have caused a series of social problems. Thus the environmental impacts of mining subsidence has become a focus of research activities in China. In some Chinese mining areas, more than 30 million American dollars must be paid for the compensation of villages and lands damaged every year, and about 300-400 hectares of cultivatable lands per year are lost in each mining area. So far, more than 60,000 hectares of cultivatable lands have been damaged and lost because of mining subsidence in China. According to the statistical data, the lands damaged by construction, as well as those damaged by subsidence, are equal to the cultivatable lands in all Fujian provinces.

To limit the land damage caused by mining and other industries, the State Council of People's Republic of China enacted "The stipulation of land reclamation" in 1989. The stipulation provides that the damaged land must be reclaimed by the one who damaged the land, and the reclaimed land belongs to the one who reclaimed the land.

These laws and stipulations greatly advanced Chinese mine land reclamation. According to statistics, in last four years damaged land decreased to 20% of the number of 1985.

### The Advances In Mine Reclamation Technologies In China

In China, the land damages caused by mining are divided into two different types: one occurs in so called "high ground water level" areas, another occurs in "low ground water level" areas.

The water accumulation in subsidence trough usually is the form of land damage in high ground water level areas. The reason is that the ground water surface is expose to ground surface and becomes surface water. In this case, lands are flooded, or very wet, which are uncultivated. In some areas, the water accumulated in trough may be polluted by acid mine water, which will induce a series of environmental pollution problems.

The lands in low ground water level areas usually exist the discontinuous surface damage and continuous surface deformations. The discontinuous damage leads initial ground water and irrigating water to run off through mining fractures and subsequently cause the drought which affects crop growth. Thus soil erosion becomes a big problem in this kind of area. Also the continuous deformations often lead to changes of topography. All of these influences will affect soil physical, chemical and ecological properties in the damaged lands tremendously, and the crop production will decrease.

The reclamation of lands damaged by mining are generally divided into three levels in China: farmland reclamation, local comprehensive renovation and regional reclamation planning. Some successful experiments in all the three levels have been achieved.

## I. Farmland reclamation

Farmland reclamation means that the reclaimed lands are mainly used for cultivation. Usually, this kind of reclamation links with relatively small areas and does not relate to district environmental programs in China.

In Yangquang mining area, Shanxi province, there were some successful examples of land reclamation in the mountain area with low ground water level, total 8m thickness of coal seams with mining depth 20-200m were mined out. Therefore, many problems were found: (1) ground were fractured; (2) ground water run off; (3) irrigation water resource, springs and wells were dried up; (4) soil seriously eroded; (5) lands inclined due to subsidence differences. After programming and reclaiming, the fractures were filled with clay, the water and soil loss was controlled, the inclined lands were leveled, and the crop products increased to nearly initial levels. All expenses were paid by collieries, the reclamation processes were done by farmers themselves.

In some high ground water level areas, if there are some water systems such as rivers, lakes and reservoirs which the accumulated water can drain into, then most of flooded lands can be reclaimed. An example is in Xuzhou mining area, near our university, the maximum surface subsidence is 2-3m in the area and part of lands were inundated. About 100 hectares of farm lands and a village were in effect by subsidence. A network of ditches will be dug to drain the cumulated water into a river, which is not far from the area. The biological methods were used to lower the elevation of the accumulated water surface and so call "digging deep to fill shallow" method was used to construct lands and fish ponds. After the reclamation, it is expected that about 3/4 of lands renew their capability of cultivation, and other 1/4 of lands become fish ponds or reservoirs. The village has to be moved away because it will be flooded by the accumulated water.

If there are not these water systems mentioned above to store the accumulated water, or the subsidence trough is much deeper, we have to use some filling material to fill the trough so that the lands can be higher than the ground water surface. The

filling materials are normally wastes or ashes from mines or power plants. There is an example of using ashes as filling material in Xiangchen colliery, Huaibei mining area, Anhui province. In the area, four coal seams with total thickness of 7m were mined out. The maximum surface subsidence reached to 6m. The reclamation procedure is as shown in Figure 1.

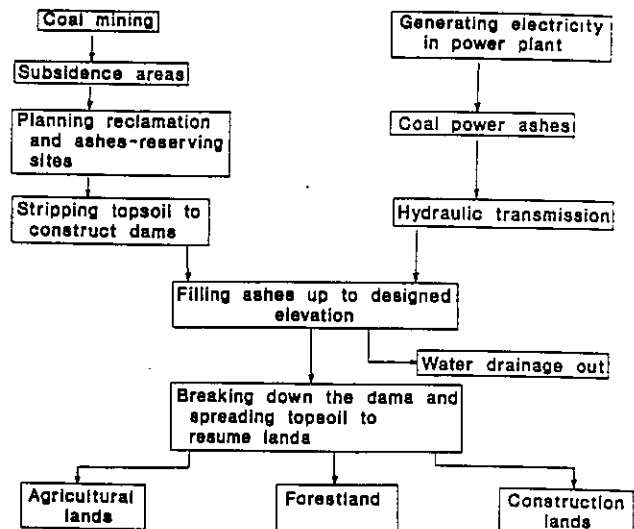


Figure 1. The flow chart of reclamation with power plant ashes

Seven types of crops such as corn, soybean, wheat, sweet potato, etc., and more than 30 types of vegetables and fruits, such as tomato, pimento, potato, radish, etc. were planted. The productions of these crops and vegetables are even higher than those of the lands before damage. The chemical tests showed that these crops and vegetables are nonpoisonous, but the content of fluorine in soybean and corn is a little higher than the acceptable value. The solution to this is currently underway. On the reclaimed forestation lands, 61 types of trees including apple trees, orange trees, willow, etc. were planted; the results are satisfactory.

## II. Local comprehensive renovation.

Local comprehensive renovation means that the reclaimed lands are not only used for agriculture, but also for construction and recreation. Generally speaking, local comprehensive renovation is related to a large area and closely linked with district environmental program. There is one example in Daihe colliery, Huaibei mining area (Gao, 1987). In the area, three coal seams with a total thickness of 6.2m were mined out. The maximum surface subsidence is

5.6m, the maximum depth of accumulated surface water is 3-5m. The filling material is wastes from mine. The renovated lands are used both for construction and agriculture. The flow chart of the lands renovations are shown in Figure 2.

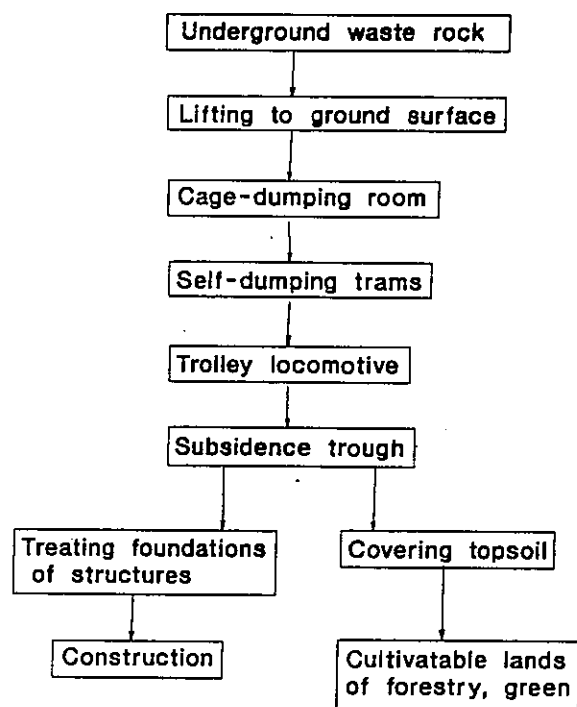


Figure 2. The flow chart of lands renovations with the filling materials of waste rock

On the renewed land, are a four-story building, a swimming pool, a lake and some subsidiary structures. After the renovation, the previous water-accumulated subsidence trough becomes a recreation center. The project has achieved great success both in techniques and economics. The wastes no longer need to pile on lands forming large dirt piles, which increases the useful lands and improves the environment.

### III. Regional reclamation planning

Regional reclamation planning is the plans for mine land reclamation in a very large area, which usually is more than 100 square kilometers, normally including several counties. The regional reclamation plan is a part of regional development environment and construction programs. A regional reclamation plan is programming for Xuzhou region including six counties with three big mining areas. The plan includes following contents:

1. The renovation plan for subsidence-damaged lands;
2. The moving and renovating plan of villages influenced by subsidence, which concerns about 300 villages.
3. The municipal installations program concerned with mining subsidence, which relates to the railways, highways, electricity transmission lines, water pipes and so forth.
4. The comprehensive reclamation plan of mining subsidence areas, which condenses all the three plans mentioned above and links them with environmental engineering and protection.
5. Two detailed project plans on the local comprehensive renovations in two collieries.

After the regional reclamation planning and implementing the plan, it is expected that a large environmental and economical benefit will be obtained.

### Summary

1. Since the average of cultivatable land per person is very limited in China, the reclamation of land is a very important problem which affects people's life tremendously. This problem has gradually attracted great attention in China.
2. Chinese government has enacted a series of laws to decrease land losses and to force damaged lands to be reclaimed in past three years. These laws have played a important role in controlling the losses of cultivatable lands.
3. Although the reclamation of land is a brand new field in China, several successful cases of reclaiming damaged mine lands have been achieved. The characteristics of the researches on land reclamation in China are that all the reclamation projects are

closely linked with economic effectiveness  
and environmental protection.

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