

Appendix 3-H

*HD Mining's China Experiences with Underground Coal Mining
and Water Management*

MURRAY RIVER COAL PROJECT

Application for an Environmental Assessment Certificate / Environmental Impact Statement



HD矿业在中国 从事井工煤矿和水管理的经验

HD Mining's China Experiences with
Underground Coal Mining and Water
Management

November 04, 2014



一、汇永控股集团及其煤矿

Part 1: Huiyong Holding Group and its Coal Mines



汇永控股集团是HD矿业的主要控股公司。其业务包括煤炭开采、洗选加工、煤产品销售等。

Huiyong Holding Group is HD Mining's major shareholder . Huiyong Holding Group's business operations include coal mining, washing and processing, and coal product sales.



汇永控股集团
Huiyong Holding Group



汇永控股集团从成立之初即着眼于全国煤炭资源整合大局，先后在山西省兼并重组小煤矿33座，建成8座煤矿，其中生产矿井6座，基建矿井2座。下面介绍它们的生产情况和地质情况。

Early on in the company, Huiyong Holding Group focused on coal resource integration in China. The company modernized and retrofitted thirty-three small coal mines in Shanxi Province and combined these operations into eight coal mines. Six of them are currently in operation and two of them are still being retrofitted. Please see the next two slides for these mines' operation and geology.



煤矿 Coal Mine	生产性质 Current Status	面积 Area (km ²)	生产情况 Coal Mine Operation			
			建设时间 Starting Construction	投产时间 Starting Operation	生产年限 Years in Operation	现生产能力 (万吨) Current Production Capacity (10k ton)
柴沟煤矿 Chaigou Mine	生产矿井 In Operation	20.09	2005年	2007年	8	900
辛安煤矿 Xinan Mine		8.44	2010年	2011年	4	600
北祖煤矿 Beizu Mine		6.99	2010年	2011年	4	500
马尾沟煤矿 Maweigou Mine		21.63	2006年	2009年	5	200
长春兴煤矿 Changchunxing Mine		19.86	-	2013年	2	400
昊兴源煤矿 Haixingyuan Mine		20.07	-	2013年	2	180
合计 Total						2780
水磨湾煤矿 Shuimowang Mine	基建矿井 In Construction	5.97	2013年	预计2014年底 Expect End of 2014	-	规划 Planning 400
金辛达煤矿 Jinxinda Mine		11.00	2013年	预计2014年底 Expect End of 2014	-	规划 Planning 200
合计 Total						600

生产情况 Operation



煤矿 Coal Mine	煤矿地质情况 Coal Mine Geology					涌水量预测 In-flow Rate Prediction (m ³ /d)		矿井涌水量 Current In-flow Rate (m ³ /d)
	煤层数 (层) Number of Coal Seams	主采煤层平均厚度 Average Thickness (m) Main Coal Seam	煤质 Coal Quality	储量 (亿吨) Reserve (100M ton)	主要煤层埋深 (米) Depth of Main Coal Seam (m)	正常 Normal	最大 Maximum	
柴沟煤矿 Chaigou Mine	3	23.9	气煤 gas coal	3.7	230-300	3370	5055	2280
辛安煤矿 Xinan Mine	5	7.47	长焰煤, 气煤 long flame coal, gas coal	1.3	160-250	216	324	153
北祖煤矿 Beizu Mine	2	13.18	气煤 gas coal	1.6	130-200	86	130	110
马尾沟煤矿 Maweigou Mine	4	2.19	贫煤, 贫瘦煤 meager coal, meager lean coal	2.5	170-220	1520	2280	1704
长春兴煤矿 Changchunxing Mine	2	11	气煤, 长焰煤 gas coal, long flame coal	3	230-280	2560	3200	1100
昊兴源煤矿 Haixingyuan Mine	4	2.66	气肥煤, 肥煤 gas fat coal, fat coal	0.73	110-170	188	280	140
合计 Total				12.83				
水磨河煤矿 Shuimowang Mine	4	6.9	气煤 gas coal	0.99	-	-	-	-
金信达煤矿 Jinxinda Mine	3	6.16	肥煤 fat coal	0.78	-	-	-	-
合计 Total				1.77				

地质情况 Geology



二、柴沟煤矿矿井涌水量及其水循环利用

Part 2: Chaigou Mine Inflow and Water Recycle



在上述八个矿井中，柴沟煤矿最接近墨玉河煤矿。

Among the eight coal mines, Chaigou Mine is the most similar with Murray River Coal Mine.





1、柴沟矿简介

柴沟矿由13个小型煤矿整合而成，整合矿井于2005年开始建设，2007年投产，现在年生产能力约900万吨。井田总面积20.09平方公里，保有储量3.7亿吨。井田共赋存3、5(3~5)、8三个主采煤层，其中3号煤层平均厚10.05米、5(3~5)号煤层平均厚23.90米、8号煤层平均厚6.41米。各煤层均以气煤为主，主要作为动力用煤。主要煤层埋深约230-300米左右。矿井预计正常涌水量为3370m³/d，最大涌水量为5055 m³/d，目前生产矿井实际涌水量平均为2280m³/d。

1. Summary of Chaigou Mine

Chaigou Mine was integrated from thirteen small coal mines. The integrated mine was started construction in 2005 and began production in 2007. Currently the yearly production capacity is about nine million tons. The total mine area is 20.09km², and available coal reserves are 370 million tons. There are #3, #5 (3-5) and #8 three major coal seams. The average thickness of #3 is 10.05m, and #5 (3-5) is 23.90m, #8 is 6.41m. All coal seams are gas coal, mainly used for power. Depth of major coal seams is 230-300m. It was predicted that inflow rate at normal conditions is 3,370m³/d, and the maximum inflow rate is 5,055m³/d. Currently the actual inflow rate is averagely 2,280m³/d.



面积 Area (km ²)	生产情况 Coal Mine Operation				煤矿地质情况 Coal Mine Geology					涌水量预测 In-flow Rate Prediction (m ³ /d)		矿井涌水量 Current In-flow Rate (m ³ /d)
	建设时间 Starting Construction	投产时间 Starting Operation	生产年限 Years in Operation	现生产能力 (万吨) Current Production Capacity (10k ton)	煤层数 (层) Number of Coal Seams	主采煤层平均厚度 Average Thickness (m) Main Coal Seam	煤质 Coal Quality	储量 (亿吨) Reserve (100M ton)	主要煤层埋深 (米) Depth of Main Coal Seam (m)	正常 Normal	最大 Maximum	
20.09	2005年	2007年	8	900	3	23.9	气煤 gas coal	3.7	230-300	3370	5055	2280

柴沟煤矿生产、地质、涌水量概况
Chaigou Mine Operation, Geology, and Inflow



2、柴沟煤矿矿井涌水量与用水量概况 Chaigou Mine Water inflow and Consumption Rate

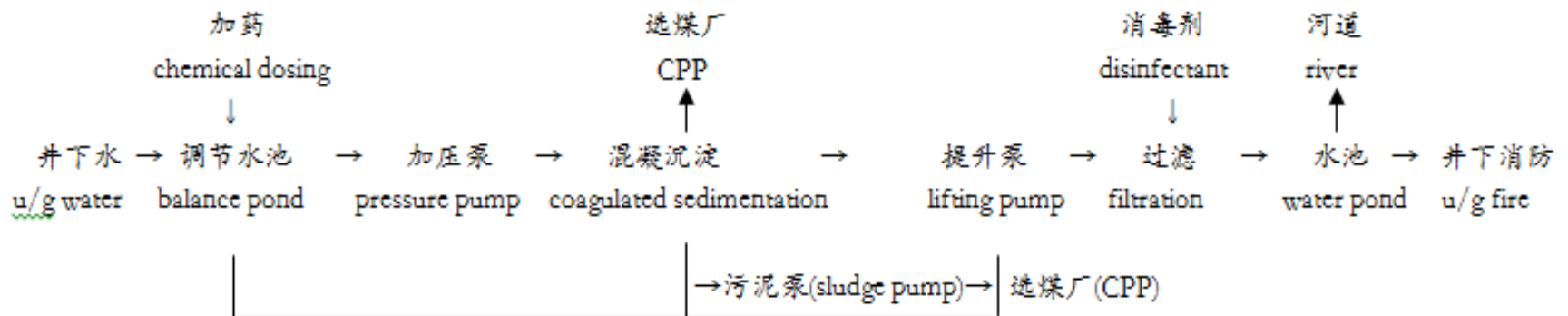
柴沟煤矿2013年和2014年矿井涌水量与用水量概况 (单位: 方/天) Chaigou Mine Water In-flow and Consumption Rate in 2013 and 2014 (m ³ /d)													
年度 Year	月 Month	1	2	3	4	5	6	7	8	9	10	11	12
2013	矿井涌水量 Mine In-flow	1560	1506	1506	1560	1680	1680	1680	1860	1920	1800	1800	1800
	矿井用水量 Mine Consumption	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	2050	2050
2014	矿井涌水量 Mine In-flow	2040	2040	2040	2040	2040	2040	2160	2280	2280			
	矿井用水量 Mine Consumption	2050	1850	1850	1850	1850	1850	1850	1850	1850			
备注: 2013年11月到2014年1月1507工作面注水, 每天注水量约250m ³ 。 Note: From November 2013 to January 2014, water was injected to #1507 working face. The volume is about 250m ³ /d.													

柴沟煤矿2013年和2014年矿井涌水量与用水量概况(单位:方/天)
Chaigou Mine Water inflow and Consumption Rate in 2013 and 2014 (m³/d)



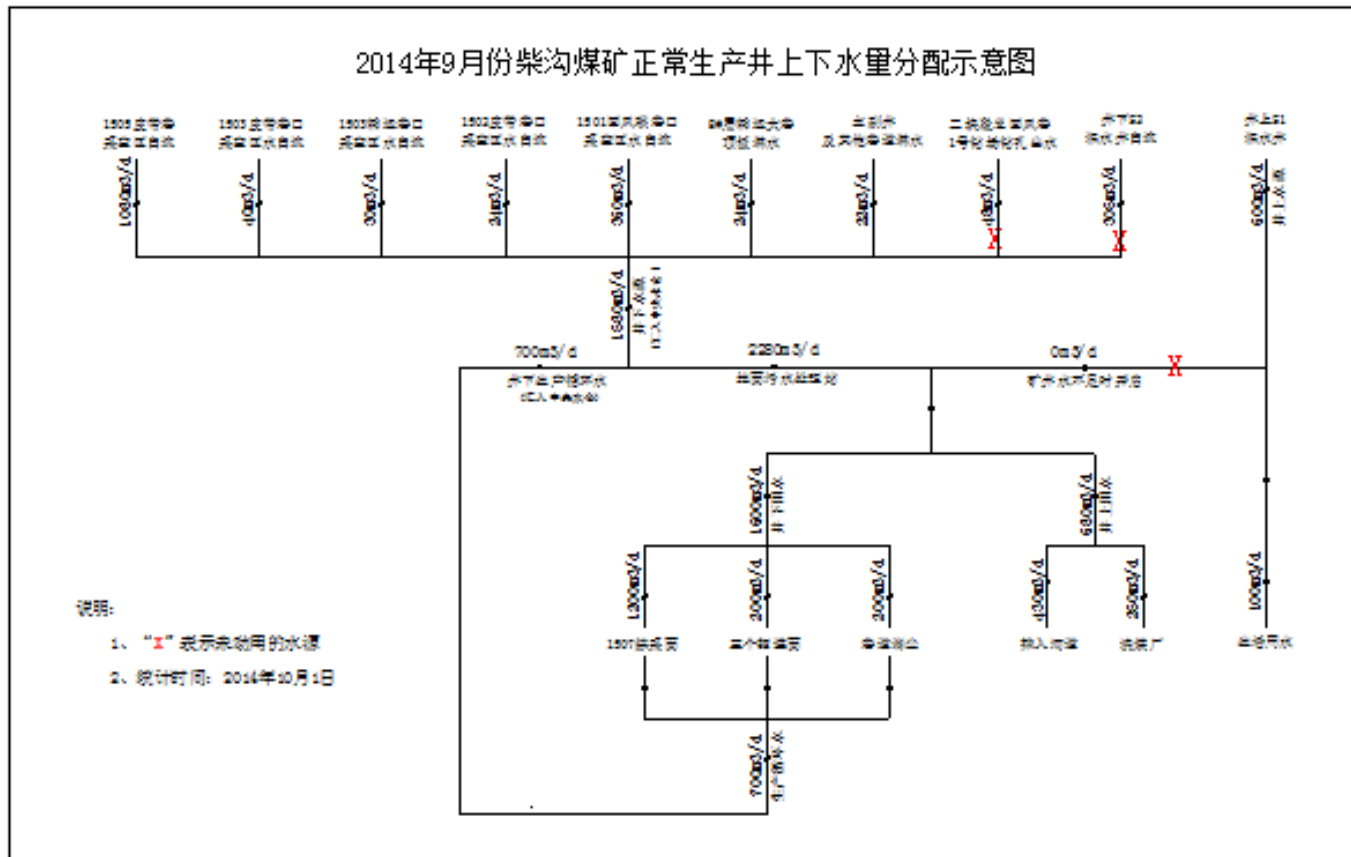
3、井下污水处理流程

The Process of U/G Water Treatment





4、井下水利用率 (U/G Water Utilization)



Chaigou Mine U/G and Surface Water Allocation in September 2014



5、矿井排水系统设计

该矿井正常用水量预测为 $3370 \text{ m}^3/\text{d}$ ，最大涌水量预测为 $5055 \text{ m}^3/\text{d}$ 。在副井底部车场位置，设置了主水仓和主泵房，主泵房选用多级离心泵3台。每台泵小时排水量为 $280 \text{ m}^3/\text{h}$ ，20小时排水量为 5600 m^3 。正常涌水时，1台工作，1台备用，1台检修。最大涌水时，2台工作，1台检修。排水管路为两趟 $\text{D}219 \times 7$ 无缝钢管管路，正常涌水时一趟管路工作，一趟管路备用，最大涌水时两趟管路全部工作。

5. Mine Drainage System Design

It was predicted that the mine inflow rate at normal condition is $3,370 \text{ m}^3/\text{d}$, and the maximum inflow rate is $5,055 \text{ m}^3/\text{d}$. A main sump and pump station were set at the bottom of service decline. There are three multi-stage centrifugal pumps. Each pump's water discharge is $280 \text{ m}^3/\text{h}$, so it can discharge $5,600 \text{ m}^3$ in 20 hours. At normal inflow, one pump works, and the second pump is in backup, while the third one in maintenance. At maximum inflow, two pumps will work and the third pump is in maintenance. There are two sets of $\text{D}219 \times 7$ seamless steel pipes for water discharging. At normal inflow, one pipe works and another pipe is in backup. At maximum inflow, both pipes will be working.



6、矿井防治水管理机构的设置

矿井设置了以矿长牵头，总工程师为技术负责，专业副总具体负责的防治水领导机关。按时完成不同阶段的治水任务，保证矿井的安全。

6. Water Prevention and Control Management Agency

The mine set up a water prevention and control management agency. Within the agency, Mine Manager takes the lead, and Chief Engineer is responsible for technology, while professional Vice General Manager is in charge of specific water prevention and control measures. The agency completes water prevention and control tasks timely in different periods and ensures the safety of the mine.



7、矿井基建和生产过程中防治水的业务工作

- (1) “堵”：封堵，让水不流出来
- (2) “防”：预防，即避开含水体
- (3) “探”：指通过钻探或物探手段查明不明水体
- (4) “疏”：对有威胁的含水区域，在不适宜避开的情况下，一般采用钻探等方法，将其提前疏放掉，解除其安全威胁。
- (5) “排”：即井下排水；
- (6) “截”：将水截流或将水引开。

7. Water Prevention and Control during Mine Construction and Operation

- (1) “Block”: So the water does not flow out;
- (2) “Prevent”: Avoid aquifer;
- (3) “Explore”: Explore unclear aquifer by drilling or geophysical exploration;
- (4) “Release”: Release water by drilling or other methods if aquifer cannot be avoided;
- (5) “Discharge”: U/G water discharge;
- (6) “Intercept”: Intercept or divert water.



三、中国矿井水文地质的基本方法和要求，并结合分析墨玉河煤矿的水文地质条件

Part 3: Basic Methods and Requirements of Hydrogeology in China, combined the analysis of hydrogeological conditions for Murray River Coal Mine



1、井工开采水文地质精查勘查类型的划分标准

(1) 按直接充水含水层空间特征，把煤矿水文地质勘查划分为三类：
第一类，以松散层孔隙含水层为主的矿床，称孔隙充水矿床；
第二类，以碎屑岩裂隙含水层为主的矿床，称裂隙充水矿床；
第三类，以碳酸盐岩岩溶含水层为主的矿床，称岩溶充水矿床；

1. U/G Mine Detailed Hydrogeology Exploration Classifications:

(1) Three types of hydrogeology exploration can be divided based on characteristics of direct water-filled aquifer:

Type one: Pore water-filled deposit;

Type two: Fracture water-filled deposit;

Type three: Karst water-filled deposit.



(2) 按直接充水含水层的富水性及补给条件, 并结合煤层与当地侵蚀基准面的关系等其他因素, 把各类矿床划分为3型:

第一型: 水文地质条件简单的矿床,
第二型: 水文地质条件中等的矿床,
第三型: 水文地质条件复杂的矿床

(2) Based on water yield property and supply conditions of direct water-filled aquifer, and combined the relations of coal seams and local erosion surface, three types of hydrogeology exploration can be divided as the following:

Type one: Simple hydrogeology condition deposit;

Type two: Medium hydrogeology condition deposit;

Type three: Complex hydrogeology condition deposit;



2、墨玉河煤矿类型划分结果及勘探要求

按照以上划分，墨玉河煤矿先期规划区域(37km²)以裂隙含水层为主，经实测，单位涌出量最大为3.7*10⁻⁶L/m.s，远小于0.1 L/m.s，井田划为二类二型，属于水文地质条件简单的矿井，不需要进行群孔抽水试验，水文地质钻孔宜布置3个或3个以上，每孔对直接含水层进行抽水试验，每含水层位可选择1到4个点进行抽水试验。

2. Type of Murray River Coal Mine and its Exploration Requirements

According to the classifications mentioned above, Murray River Coal Mine (area 37km²) is mainly a fracture water-filled deposit. From the actual measurement, the maximum unit inflow is 3.7*10⁻⁶L/m.s, which is far less than 0.1 L/m.s. The coal mine belongs to simple hydrogeological condition deposit, and there is no need to carry out multi-holes pumping test. Three or more hydrogeology drilling holes are appropriate. Pumping test can be carried out at direct aquifer of each hole and 1 to 4 positions of each aquifer can be selected as pumping tests.



四、矿井涌水量及最大涌水量的计算

Part 4: Mine Inflow and Maximum Inflow Calculation



1、比拟法

比拟法是一种应用相当广泛的传统方法。它是当新矿井与生产矿井的水文地质条件相类似时，用生产矿井的资料来预测新矿井涌水量的方法。比拟法包括富水系数法、钻孔比拟法、矿井单位涌水量比拟法、相关关系分析法等。

1. Analogue Method

Analogue method is a traditional method with a wide range of application. When hydrogeology conditions of a new mine is similar to an operational mine, data of the operational mine can be used to predict new mine's inflow rate. Analogue method includes water-rich coefficient method, drill hole analogue method, mine unit inflow analogy method, correlation analysis method, etc.



2、解析法

解析法是根据地下水动力学的原理，用数学分析的方法，针对具体的水文地质条件进行理想化，同时各种计算参数的选择也有很大的人为因素。其计算结果是否准确与公式及参数的选择是否合理有很大的关系。

不同的边界条件下，矿井涌水量计算公式有很多。稳定流条件下，常用的基本方法如下：

- (1) 大井法
- (2) 狭长地沟法(水平廊道法)

2. Analytical Method

Analytical method is a type of mathematical analysis, based on the principle of groundwater dynamics, and idealized at specific hydrogeological conditions. While there will be many human factors in a variety of computing parameters selection. Whether the calculation results are accurate has a great relationship with the reasonable formula and parameters selections. Under different boundary conditions, there are many mine inflow calculation formulas. At steady flow conditions, the common basic formula are as follows:

- (1) Big well method;
- (2) Narrow trench method (Horizontal corridor method)



请提问！
Questions?