

First International Symposium on Mine Safety Science and Engineering

The Application of Analytic Hierarchy Process in Mine Gas Prevention System

Zhang Jianqing^{a,b} a*

^aFaculty of Resource and Safety Engineering, China University of Mining & Technology, Beijing 100083, China

^bFinancial Assets Department of Shengli Oilfield Branch, Dongying 257001, China

Abstract

In the assessment of mine gas prevention and control system, how to determine the weight of every main influence factor is a significant problem. In order to construct the mine gas prevention and control system sufficiently and reasonably, it is necessary to study the assessment indexes of the mine gas prevention and control system with the method of analytic hierarchy process, and determine the weight of each index, in the meantime, base the assessment on the quantization result of indexes. The study result shows that the main factors in the mine gas prevention and control system are gas monitor, gas outburst, ventilation condition and gas drainage. The weight value of each factor is determined through the method of analytic hierarchy process. The analysis results calculated accord with the practical situation, thus providing the direction for the survey of the assessment of the mine gas prevention and control system.

© 2011 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of China Academy of Safety Science and Technology, China University of Mining and Technology(Beijing), McGill University and University of Wollongong.

Keywords: Coal Mine; Gas Prevention; Analytic Hierarchy Process (AHP); Assessment; Weight

1. Introduction

Coal is the major energy in our country, whose proportion occupies more than 70% in primary energy consumption. More than 95% coal mine in our country are mined underground, the occurrence condition in the coal seam is poor and the geological diversity is varied. The disaster from the gas, water, fire and the floor threatens the work safety underground constantly. Among them, the gas disaster is the most serious ^[1]. According to the information announced on the website of State Administration of Work

* Corresponding author. Tel.:05468795766

E-mail address: Zhangjianqing.slyt@sinopec.com

Safety, the total number of the gas accidents happened in the first half year of 2011 involved 62,245 people dead^[2]. Therefore, the whole level of the coal mine gas prevention must be promoted, and the assessment of its prevention system must be accurate, thus to guarantee that the system can reach the requirement of the national gas comprehensive treatment.

In recent years, the method of AHP has been applied vastly in every coal mine field^[3-8]. The AHP builds the hierarchical assessment system firstly, and each hierarchy responds to the single target of the last hierarchy. In the same hierarchy, all the factors compare with each other. Then we have to determine its own importance degree and the order, and form the weight vector in the end, thus to distinguish their strengths and weaknesses. It is a practical assessment analysis method which combined the qualitative method and the quantitative method together. Since when we assess the condition of the coal mine gas prevention system, it is difficult to get the accurate result with the traditional qualitative expert assessment method, besides, it also exists difficult using the quantitative method due to the differences of each index importance and its values. Therefore, the application of the AHP method is a favourable approach to solve this problem. According to the analysis mentioned above, this paper adopts the AHP theory to assess the system based on the work experience of the coal mine gas prevention. And determine the weight of each factor that influences the system, thus attempting to analysis the function of the coal mine gas prevention system in safety production qualitatively and quantitatively, and then guarantee the safety of the coal mine consequently.

2. The AHP theory

The Analytic Hierarchy Process (AHP) was proposed by the American professor T.L. Satty famous in Operational Research in early 1970^[4]. It is a simple, practical and effective decision analysis method which conducts quantitative analysis to the qualitative problem. The feature is that it can dispose the experience of the analyst quantitatively, so it will be practical especially in the circumstance when the goal structure is complex and the necessary data is deficient. When analysis the system problem using the AHP method, the main produces can be summed as follows: (1)Understand the problem explicitly, and then build the hierarchical structure model; (2)Structure the judgment matrix; (3)Establish the weight values of the system; (4) Sequence the hierarchy and check the consistency; (5)Calculate the assessment result.

2.1. Build the hierarchical structure model

The key of the AHP method is to build the hierarchical structure model of the problem. According to the different goal that the system problem tries to achieve and other various factors involved, it can be divided as the destination layer (that is the goal needed to reach); the criterion layer(that means the intermediate link involved when adopting some kind of measure to realize the intended target); the program layer(means the various projects and measures adopted to solve the problem). As the current survey needs, we usually select the form of block diagram to illustrate the hierarchical structures in different hierarchy visually and the affiliation among the various factors. It can be shown in Fig.1.

Generally speaking, it suits the research problem that only needs to build three-hierarchical assessment models. Because the number of the assessment index on the third hierarchy is capable of contenting the analysis need, and can also be easy to quantify. Since the assessment index in the lower layer may cause influence of different degree to the index in many up layer, therefore, the assessment model established is required to fulfil the following points: (1) possess the considerable practicality which can reflect the assessment goal;(2) consider the content entirely, and the index meaning must be explicit; (3) the hierarchical structure have to be distinct, and the correlations must possess scientifically and rationality.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات