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Study on leakage and ventilation scheme of gas pipeline in tunnel

Hongfang Lu^{a,b,c}, Kun Huang^{a,c,*}, Lingdi Fu^a, Zhihao Zhang^a, Shijuan Wu^d, You Lyu^e,
Xinglong Zhang^e

^a School of Petroleum Engineering, Southwest Petroleum University, Chengdu 610500, China

^b Trenchless Technology Center, Louisiana Tech University, Ruston LA71270, United States

^c State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu 610500, China

^d No. 3 Gas Production Plant, Sinopec Southwest China Oil & Gas Company, Deyang 618100, China

^e PetroChina Southwest Pipeline Company, Chengdu 610000, China

ABSTRACT: Due to poor ventilation conditions in the tunnel, if gas pipeline leaks, the consequence of the accident will be more serious. Therefore, in order to avoid the explosion in the rush-repair process, the gas in the tunnel needs to be discharged. Thus, it is necessary to study the leakage law and ventilation scheme of gas in the tunnel. Based on the computational fluid dynamics (CFD) theory, this paper takes Yanyingshan tunnel of China-Myanmar gas pipeline for instance, Fluent software is used to establish the leakage model of the gas pipeline and fan model in the tunnel. The influence of different factors on the leakage diffusion law and the influence of fan locations and number of fans on gas concentration are analyzed. It can be concluded that: (1) Leakage location, leakage area and pipeline pressure have great influence on the gas leakage and diffusion, leakage hole direction and leakage form have little influence on the gas leakage and diffusion. (2) Set the block valve at both ends of the tunnel can effectively reduce the duration of leakage jet. (3) In order to make ventilation efficient, the fan should be arranged in a higher position and needs to be at a distance from the top of the tunnel. (4) Parallel use of two fans has better ventilation effect than single fan.

Keywords: Tunnel; Gas pipeline; Leakage; Computational fluid dynamics; Ventilation scheme.

1. Introduction

Based on the report “Gas Pipeline Incidents” written by EGIG (European Gas pipeline Incident data Group), from the statistical data from 1970 to 2013, the accident caused by construction defects or material failures accounts for 16% of all accidents (EGIG, 2015). In 2006, a gas pipeline in Respublika Severnaya Osetiya-Alaniya exploded, the gas pipeline passed through a tunnel and tunnel collapsed by this accident. After that, the pipeline exploded again, and the pipe was forced to stop (Zhang et al., 2016). Therefore, after the gas pipeline leaks in the tunnel, emergency repair needs to be done, and gas gathered

*Corresponding author.

E-mail address: swpuhk@foxmail.com (K. Huang).

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