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Authors: Yajun Deng, Hongbing Hu, Bo Yu, Dongliang Sun, Lei Hou, Yongtu Liang



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# A method for simulating the release of natural gas from the rupture of high-pressure pipelines in any terrain

Yajun Deng<sup>1</sup>, Hongbing Hu<sup>1</sup>, Bo Yu<sup>2,3\*</sup>, Dongliang Sun<sup>2,3</sup>, Lei Hou<sup>1</sup>, Yongtu Liang<sup>1</sup>

<sup>1</sup> National Engineering Laboratory for Pipeline Safety, Beijing Key Laboratory of Urban Oil and Gas Distribution Technology, China University of Petroleum, Beijing, 102249, China

<sup>2</sup> School of Mechanical Engineering, Beijing Institute of Petrochemical Technology, Beijing 102617, China

<sup>3</sup> Beijing Key Laboratory of Pipeline Critical Technology and Equipment for Deepwater Oil & Gas Development, Beijing 102617, China

\*Corresponding to Prof. Yu: yubobox@vip.163.com

## Highlights

- (1) An improved jet model for the rupture of natural gas pipelines is proposed.
- (2) A fast-modeling method applicable to any terrain is introduced.
- (3) A dispersion model, which can take any terrain into consideration, is established.
- (4) Dispersion scenarios of full-bore rupture release in any terrain can be determined in advance using the proposed method.

**Abstract:** The rupture of a high-pressure natural gas pipeline can pose a serious threat to human life and environment. In this research, a method has been proposed to simulate the release of natural gas from the rupture of high-pressure pipelines in any terrain. The process of gas releases from the rupture of a high-pressure pipeline is divided into three stages, namely the discharge, jet, and dispersion stages. Firstly, a discharge model is established to calculate the release rate of the orifice. Secondly, an improved jet model is proposed to obtain the parameters of the pseudo source. Thirdly, a fast-modeling method applicable to any terrain is introduced. Finally, based upon these three steps, a dispersion model, which can take any terrain into account, is established. Then, the dispersion scenarios of released gas in four different terrains are studied. Moreover, the effects of pipeline pressure, pipeline diameter, wind speed and concentration of hydrogen sulfide on the dispersion scenario in real terrain are systematically analyzed. The results provide significant guidance for risk assessment and contingency planning of a ruptured natural gas pipeline.

**Keywords:** Numerical simulation; Natural gas; Pipeline rupture; Dispersion scenario; Any terrain

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