

Study on Minimum Safety Protection Distance of High-Pressure Natural Gas Pipeline Based on Physical Explosion Injury Consequences

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Abstract

High-pressure natural gas pipeline transportation has the advantages of large gas transmission capacity, low transportation cost, whereas physical explosion of the pipeline may cause casualties and property losses. Based on the theory of conversion of physical explosion energy and TNT equivalent of high-pressure natural gas pipeline, this research uses HyperMesh software to build a physical explosion model of high-pressure natural gas pipeline. The crater generated by physical explosion of pipeline was simulated and analyzed using LS-DYNA software. It can be concluded that the crater building process was completed in 0.038 s, forming spindle shaped cavity crater (9.27 m×4.86 m×3.0 m). The overpressure value of the shock wave at the center of the ground burst is 6.64 MPa according to the simulation of the generation and attenuation process of the physical explosion shock wave. Based on Sadvovsky's research conclusion on shock wave attenuation, the minimum distance required for shock wave attenuation on the ground to the safe overpressure value (0.02 MPa) is 33 m. The research conclusion is of great significance to the prediction of the consequences of physical explosion damage of high-pressure natural gas pipeline and the determination of the safe laying scheme.

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