INTISARI

Dalam kegiatan penyaluran gas melalui *pipeline*, upaya untuk menjaga kesinambungan, kehandalan dan keamanan penyaluran gas menuntut strategi pencegahan melalui inspeksi dan pemeliharaan secara rutin. Meskipun berbagai upaya telah dilakukan untuk mencegah terjadinya kebocoran gas, namun beberapa faktor seperti kerusakan material, gangguan pihak ketiga, gigitan hewan pengerat (khusus untuk *pipeline* polyethylene), dan hasil konstruksi yang kurang baik menjadi faktor yang dominan dan relatif sulit untuk dikendalikan. Untuk itu identifikasi, pengetahuan dan pengendalian risiko kebocoran gas dan proses penanganan yang cepat saat terjadinya kebocoran gas menjadi upaya yang terus dioptimalkan. Penelitian terkait dispersi kebocoran gas melalui *pipeline* perlu dikembangkan agar jangkauan dan pola dispersi kebocoran gas pada permukaan tanah dapat diketahui. Selain itu, saat survei kebocoran gas di jalur *pipeline* menunjukkan indikasi kebocoran, maka melalui pola konsentrasi gas yang diukur tersebut dapat di analisis dan diprediksi lokasi kebocoran pada *pipeline*.

Analisis numerik dispersi kebocoran gas pada *pipeline* yang tertaman tanah ini menggunakan *software* Ansys-Fluent. Model simulasi telah dikomparasi dan divalidasi berdasarkan penelitian yang serupa sehingga layak untuk disimulasikan dalam beberapa variasi tekanan operasi penyaluran gas alam, permeabilitas tanah (variasi lapisan timbunan *pipeline*), dan posisi titik kebocoran gas pada *pipeline* arah pukul 12, 6 dan 3. Konsentrasi gas di permukaan lapisan timbunan *pipeline* yang dibagi menjadi 5 (lima) area diperoleh dari perbandingan nilai antara total laju aliran massa tiap area dibandingkan dengan nilai laju aliran massa kebocoran gas yang diperoleh dari lubang pada *pipeline*.

Hasil penelitian menunjukkan bahwa jangkauan dispersi kebocoran gas di permukaan tanah atau aspal pada kisaran total konsentrasi 65%Vol - 70%Vol untuk radius dari titik kebocoran *pipeline* sampai dengan 2,5 meter. Perbedaan titik kebocoran *pipeline* menyebabkan perbedaan pola dispersi gas dalam media berpori dan juga memberikan pengaruh terhadap distribusi konsentrasi %Vol gas di permukaan lapisan timbunan *pipeline*. Posisi titik kebocoran pada *pipeline* juga dapat diperkirakan dengan melakukan pengukuran pusat konsentrasi gas dan kecendrungan perubahan konsentrasi gas yang menjauh dari pusat konsentrasi gas tersebut.

Kata Kunci: computational fluid dynamics (CFD), kebocoran gas alam, jaringan pipa gas,

ABSTRACT

In gas distribution through pipelines network, the efforts to maintain the continuity, reliability and safety of gas distribution require prevention strategies by routine activities of inspections and maintenance. Although various efforts have been made to prevent gas leakage, several factors such as material damage, third party disturbances, rodent bites (especially for polyethylene pipeline), and poor construction results are dominant factors and relatively difficult to control. For this reason, identification, knowledge and control of the gas leakage risk and a fast handling process when a gas leakage occurs are efforts that eager to be optimized. The research that related to the dispersion of gas leakage through pipelines needs to be developed so that the range and the pattern of gas dispersion at the ground surface can be identified. In addition, when a gas leak survey in the pipeline shows an indication of gas, the measured gas concentration pattern can be analyzed and the location of the leak in the pipeline can be predicted.

The numerical analysis of the gas leak dispersion from buried pipeline was utilized with Ansys-Fluent software. The simulation model has been compared and validated based on similar research so that it is feasible to simulate several variations in operating pressure for natural gas distribution, soil permeability (variations in pipeline backfill layers), and the position of the gas leakage point in the pipeline at 12, 6 and 3 o'clock. Gas concentrations in the surface of the pipeline backfill layer which is divided into 5 (five) areas were obtained from the value ratio between the total mass flow rate of each area compared to the gas leak mass flow rate value from the hole in the pipeline.

The results showed that the dispersion range of gas on the ground or asphalt backfill layer was in the total concentration range of 65%Vol - 70%Vol for the radius from the pipeline leak point up to 2.5 meters. The difference in pipeline leakage points causes differences in gas dispersion patterns in porous media and also affects the distribution of the %Vol gas concentration on the surface of the pipeline backfill layer. The leak point in the pipeline could also be estimated by measuring the center of the gas concentration and the tendency of changes in gas concentration away from the center of the gas concentration.

Keywords: computational fluid dynamics (CFD), natural gas leakage, gas pipeline