

Extensive investigation into ductile-iron natural gas pipeline corrosion in soils

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Abstract

In Japan, ductile-iron pipelines have been used widely for more than 65 years as water and gas pipelines because of the superior strength and toughness. This paper summarizes evaluations conducted in the Tokyo metropolitan areas for ductile-iron natural gas pipelines where neither polyethylene encasement nor cathodic protection was included at the time of construction and thereafter; therefore investigated pipelines were under the influence of corrosivity of soils. Corrosion fell into three divisions roughly according to pH range of soil, that is, 1) acid corrosion caused by iron-oxidizing bacteria at pH below 5, 2) sulfate-reducing bacteria corrosion at pH 5 to 9.5, and 3) HCO_3^- - CO_3^{2-} -corrosion at pH 8 to 12. Low resistivity and anaerobic soils likely increased the risk of differential aeration attack. It was considered that insoluble iron hydroxide formed on a surface dissolved by a significant amount of HCO_3^- , resulting in corrosion at pH above 8 in aerobic soils.