1096-74-868 **Alla V Balueva*** (alla.balueva@ung.edu), University of North Georgia, Mathematics Department, P.O. Box 1358, Gainesville, GA 30503. *Analytical Estimates for Pipe-lines Longevity.*

While estimating longevity of pipelines transporting oil and gas, it is necessary to take into account the presence of small cracks in the metal, which can be later the reason of a sudden rupture of pipelines. In addition, hydrogen diffuses into the metal of the pipelines and accumulates inside the cracks. The growth of hydrogen induced cracks is controlled by the gas diffusion. Two mixed Dirichlet-Neumann boundary value problems of elasticity theory and diffusion theory with the crack contour as a boundary for the boundary conditions are reduced to two integral equations. For sake of simplicity, we consider a penny-shaped crack, which gives an axi-symmetrical problem. The two problems then are connected through the real gas equation of state. After reducing the problem to the integral equation for the crack radius, it is possible in the steady state case to obtain a closed-form solution of how the crack radius grows with time. The results show that depending on the different external factors such as the initial gas concentration or properties of the metal, the time until the crack radius reaches a critical value (a fatal fracture) is different, changing from several days to thousands of years, which gives recommendations as to when certain parts of pipelines should be replaced. (Received September 12, 2013)