A 20-inch-diameter buried natural gas pipeline owned and operated by Columbia Gas Transmission Corporation ruptured near a sparsely populated area in Sissonville, West Virginia, on December 11, 2012. Fortunately, there were no fatalities or serious injuries. However, three houses were destroyed, and the fire ignited approximately 76 million standard cubic feet of high-pressure natural gas, which was released and burned an area 820 feet wide and 1,100 feet along the pipeline right-of-way. The operator spent about $8.4 million for pipeline repair and inspection, and they lost almost $285,000 in released gas. The investigation found that pipeline corrosion was the main source of the accident. Furthermore, there had been no inspection done on the pipeline since 1988 [4]. The integrity of the employee responsible for pipeline inspection and maintenance was questionable and capable of influencing the perception of the stakeholders. Hence, the operator’s good reputation was endangered.

Previous research regarding consequence assessment of pipeline failures has commonly considered the monetary loss of an accident, while reputation loss has been neglected because the data is difficult to quantify [6, 7]. Tangible human, environmental, and asset losses are calculated at the time of the event. On the other hand, reputation loss is time-dependent and it relies on the critical to the event [8, 9]. An effort to measure reputation loss for a pipeline accident is done based on the coverage range the event receives [10] and the level of public concern. However, this method does not portray the actual perceptions of stakeholders, and the definition of reputation is the beliefs of the stakeholders towards a company and its attributes [5]. Reputation is measured using an index-based method and vital to most organizations [11] because it affects company’s profit margin [12].

This paper will discuss the factors that contribute to the loss of pipeline operator reputation due to accidents caused by corrosion. Six pipeline operator experts were interviewed, and questionnaires were answered. The multiple decision-making criteria of the analytical hierarchy process (AHP) with a weighting method were implemented to process the information received.

Experimental

In order to prioritize the factors of operator reputation loss due to a corroded pipeline, the methodology of the study is as follows:

- Gather the factors influencing stakeholders’ perceptions that eventually contribute to the loss of an operator’s reputation in the pipeline accident reports.
- Sort the factors corresponding to the stakeholders and structure the decision-making problem into a hierarchical framework.
- Design the questionnaire and input the responses in the AHP integrated software called Super Decision.
- Make a pairwise comparison of elements at each hierarchy level with respect to each element on the preceding level.
- Prioritize the factors and rank the reputation loss factors.

Data Analysis

Ten cases of natural gas pipeline accidents initiated by corrosion in various countries were studied, and 22 operator reputation loss factors were identified. These factors were then sorted according to their corresponding stakeholders and numbered as indicated in Table 1. As shown in Fig. 1, a hierarchical structure was constructed with attention to creating hierarchical influence between the goal (to prioritize the factors), the criteria (stakeholders), and the subcriteria (reputation loss factors corresponding to the stakeholders). Based on this structure, a questionnaire was designed and distributed to six experts to achieve the goal. A comprehensive questionnaire and interview sessions were conducted with managers, engineers, and other operator personnel who worked in pipeline integrity management previously or in the present day. The experts were asked to perform a pairwise comparison using an AHP fundamental scale assigning weights as given in Table 2.