PIPELINES SAFETY IMPROVEMENT THROUGH CONTROLLING RODENTS

Etemad[1], N., Bahramian[2], N., Yosefypour[3], M.R.,
1. Research Institute of Petroleum Industry, Iran
2. National Iranian Gas Company, Iran
3. HSE Manager Iranian Gas Company, Iran

Abstract: Natural gas is the cleanest fossil fuel in the world and is the most valuable source of energy in our time. As a green energy, it is obvious that the production, transmission, distribution and consumption of natural gas contribute to getting to the level of sustainable supply and demand. One of the major challenges in the gas industry in regard to transmission process is the question of pipeline safety and extensive research is undertaken to optimize the safety issues through implementing new techniques. In recent years, it is reported that polyethylene pipes with diameter of 25 mm are attacked and damaged by rodents. To tackle with this problem a plan was purposed in accordance to ecological rodent management measures. The plan aimed at combining basic and applied research on rodents control in order to provide protection to the gas pipelines. In this survey, after identification of the rodents' species, a risk map was drawn and different methods from the application of physical barriers to using repellents were examined. Results showed that meshes, stones and a couple of different natural based masterbatches as repellents could reduce the damage. The findings of the study showed that there is a need for the review of the polyethylene pipelines installation guidelines.

Keywords: Anti- rodents; polyethylene pipes; repellent; physical barriers

1 INTRODUCTION

Iran is the second gas producer in the world. Polyethylene pipes replaced steel pipes in the last two decades due to their quick and easy installation and their being cheap.

There had been several reports on the damage inflicted by rodents on these pipelines from different provinces around the country. Although, the number of incidents has not been

statistically considerable, they could not be ignored as the incidents endangered the safety of the people in the affected areas.

The polyethylene pipes as shown in the Figure 1 are installed in a depth of 120 cm on a layer of soft soil of 10 cm before backfill operation.

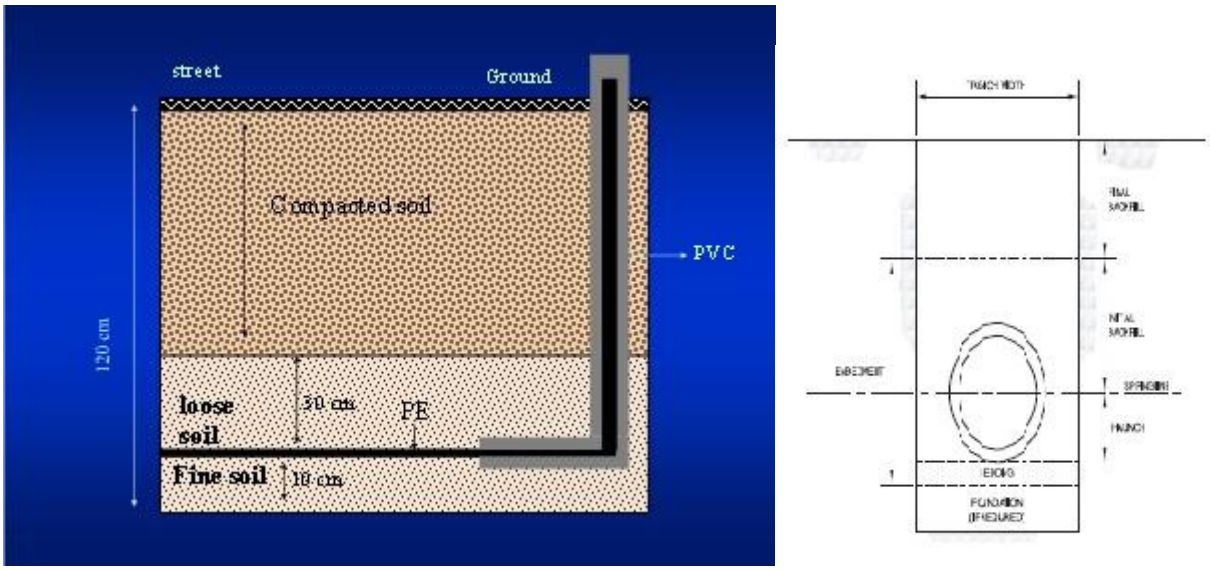

Figure 1- Polyethylene pipes under the ground

These pipes will be easily damaged by rodents as shown in the following photos.

Figure 2-Damaged pipes

Rodents are the largest group of mammalian and characterized by long front incisors teeth adapted for gnawing and cheek teeth adapted for chewing. They are adapted to gnawing, running, jumping, climbing, burrowing, swimming and gliding. Rodents have a worldwide

distribution and can be found in almost every habitat. They can gnaw through a wide range of materials and destroy insulation, electrical wiring, plumbing (pipes) and other structural components.

To solve this problem a plan was purposed in accordance to ecological rodent management measures. Developing an integrated management plan made it necessary to study rodents' ecology and distribution as the case might have been because in each case a different method needed to be applied.

There are various methods for controlling rodents in related literature, but most of these techniques needed modification to yield the best management practice.

2. METHODS

2.1 Identification of the most aggressive species

The first stage of the plan was the identification of rodents' species in the affected areas. The assumption was to find out the most aggressive species in order to allocate available resources properly. The trapped species, either dead or alive were categorized. The two most aggressive species identified were *Nesokia* (also known as *Bandicota*) and *Merrion*. It was necessary to study the habitat of these species before developing any controlling methods. Figure 3, Shows the sampling stage and the most aggressive species.

Figure 3- Rodent Trapping

The next stage of the plan was to draw a risk map of the damage areas to pinpoint the locations which were potentially at a higher risk. The risk maps showed that these locations had similar climatic conditions and land use application. The most extensively damaged pipes were installed

in areas near rural area plantations, drainage ducts, and livestock barns. The following division was done on the basis of findings in this phase.

In cities the main damage was inflicted on razor pipes, as rats in the urban area could not reach other installations while in rural area they may attack underground pipes if they were not installed properly. After identification of the rodents' species and the high risk areas, for performing each test new samples were captured and acclimatized for two weeks.

2.2 PHYSICAL - CHEMICAL BARRIERS

A number of various methods to control rodents are referred to in the related literature, but most of these techniques needed modification to yield the best management practices. These methods range from physical to biochemical applications used in protection of polyethylene pipes. These methods were examined in lab, semi field and field trials in four provinces of Iran. In one of the research field experiments, the pipes were covered by stainless- steel mesh, rock shield or a layer of «one- inch» stones with a thickness of 10 cm before being installed in the semi- field trials. Figure 3 shows the coated and stony- covered pipes.

Figure 3 - Coated & Stony covered pipes

The other approach was the protection of the pipes using rodents repellents either in soil or as masterbatches in the pipes structure.The efficiency of two chemicals(repellents), namely Capsaicine and Thiram were assesed as possible protective substances in the soil backfills around pipes**.** Also there are a number of commercially available masterbatches containing natural repellents. They can either be used in Extruder with the plain polyethylene resins to make pipes with anti- rodent properties or in manufacturing of wrapping films which shall be applied around pipes. Figure 4 shows the pipe wrapped with the anti-rodent film used in the field trials.

Figure 4- The Sample of Wrapped Pipe

The manufacturings of polyethylene pipes containing the commercial repellants and repellency tests in the lab scale were the other steps of the project. The figure 5 shows the impact of the rodents attack on the two types of polyethylene Pipes, blank one and those which contained repellents. This figure well illustrates that the blank polyethylene pipe has turned out to chips after being attacked by rodents whereas rodents could not attack the other one (repellent type).

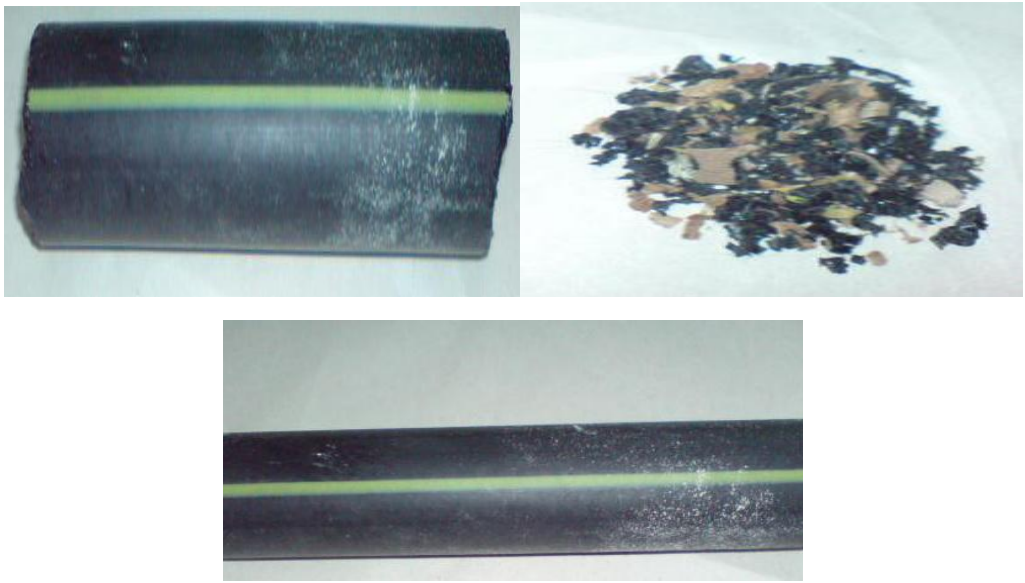

Figure 5 – The Blank Pipe vs. the Pipe Containing Anti-rodents

3. Conclusion

Use of polyethylene pipe results in a more cost-effective and safer piping system compared with steel pipe in the gas distribution networks. The sustainability of installation and life time against rodent attack needs devising a number of protective measures correspondingly in any region. The designing and implementation of the polyethylene installation projects depends on the pipes' types, soil texture and the land use. There are other factors such as trench dimension and bedding that need to be considered in to choose the best implementation practices. The site location must also be studied before the designing of any process.

Specific conclusions from this research regarding the protection of PE pipes against rodents are as follows:

- The ecology and land use change are factors to be considered before any installation of polyethylene pipes in the Iranian gas application.
- Physical barriers such as stones, bigger diameter casing for small diameter polyethylene pipes, rock shield and stainless steel mesh can protect the pipes.
- The use of chemical barriers such as Capsaicin and the commercial master batches containing repellents can protect pipes to a great extent.
- The implementation of revised guidelines considering rodent ecology and habitats is crucial for a sustainable installation.

REFERENCES

1. D.E. Wilson and D.E. Reeder, Mammal Species of the World: A Taxonomic and Geographic Reference, 2nd edition. Smithsonian Institution Press, Washington D. C., 1993, 1206 p.

2. Mark et al, wildlife management, Lute rut Center for USDA National wildlife Research center, staff publications, 2004.

3. N. Etemad, F. Zarani, A. M. Rezaeezadeh, Protection of gas pipes through the modification of the soil, Technical Report,64530111,2009.

4. S.A. Shumake, R.T. Stemer, and S.E. Gaddis, Repellents to reduce cable gnawing by wild Norway rats, J. Wildlife Management,2000, 64,1009-1013.

5. US Environmental Protection Agency, Registration Eligibility Document, Pesticide and Toxic Substance, Washington DC, 1992a.