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Remedy to Locate Buried LDPE & MDPE Gas Pipes

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Abstract:
PE pipes such as LDPE & MDPE are used in gas distribution industries, such as MGL. It is difficult to locate the pipe below earth surface when buried. Here in this project we focused on the detection of LDPE & MDPE which are buried in to the sub surface. Different process are shown in the project as Acoustic method, Ground penetrating radar, Electromagnetic conductivity (EM), Ultra-High Radio Frequencies, these all techniques are complicated to locate PE pipes, for that purpose we give a different remedy using metal detector to locate buried pipes and the steps which we are including to detect the gas pipe. The research will be helpful to detect the buried gas pipes, result in saving life of people and we will be able to locate pipe even after 10 years and even also after losing documents.

Keywords: PE pipes, LDPE, MDPE, Acoustic method, Ground penetrating radar, etc…

I. INTRODUCTION

Increasing the utilization of natural gas in the India will require development of additional pipeline systems and increased use of existing pipeline infrastructure. Maintaining a safe and environmentally-sound natural gas pipeline network in the face of this growing utilization will represent a major challenge facing the pipeline industry. This paper analyses some of the major causes of adverse pipeline incidents and provides an overview of the safety measures currently used to prevent and mitigate these types of incidents. This paper also recommends measures for improving existing pipeline safety measures so that increased natural gas utilization can be achieved while avoiding a proportionate rise in adverse pipeline incidents. As a transportation method, pipelines are becoming more and more important in many countries. Many new national and international pipelines are being planned and constructed every year. Urbanization in both developing and developed countries also shows expenditure on GAS distribution networks increasing at a significant rate. In the Mumbai itself 4,000 km of new gas distribution pipelines are installed annually based on data from the MGL. With the wide application of pipelines, a variety of failures of pipeline operation from gas pipe rupture, gas pipe explosion to oil leakage have been reported every year. The failure of a pipeline could be the result of one or several factors including corrosion of the pipe wall, abnormal pressure surge, poor quality of fittings and workmanship, soil movement, traffic loading and aging of the pipeline. Analysis of the most recently available data indicates that, despite emphasis by regulators and operators, the rate at which pipeline accidents occur shows no significant change over the last few years. Based on an investigation, the leakage of gas distribution networks in the Asia region ranged from 8% in Singapore to 62% in Dhaka, Bangladesh. In developed countries, the situation is similar. In many countries legislation on environmental protection is becoming stricter. For pipeline utilities, pipeline leakage means not only a loss of product, but also high fines if the environment is impacted upon. Therefore, accurate locating pipe and leak detection methods that enable a quick response to pipeline failure are necessary to reduce the loss of valuable materials and to minimize the environmental damage. [8]Non-destructive testing or non-destructive testing (NDT) is a wide group of analysis techniques used in science and technology industry to evaluate the properties of a material, component or system without causing damage. The terms non- destructive examination (NDE), non-destructive inspection (NDI), and non-destructive evaluation (NDE) are also commonly used to describe this technology. Because NDT does not permanently alter the article being inspected, it is a highly valuable technique that can save both money and time in product evaluation, troubleshooting, and research. Common NDT methods include ultrasonic, magnetic-particle, liquid penetrant radiographic, remote visual inspection (RVI), eddy-current testing, and low coherence interferometry. NDT is commonly used in forensic engineering, mechanical engineering, petroleum engineering, electrical engineering, civil engineering, systems engineering, aeronautical engineering, medicine, and art. Innovations in the field of non-destructive testing have had a profound impact on medical imaging, including on echocardiography, medical ultrasonography, and digital radiography. Non-destructive testing (NDT) is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. In other words, when the inspection or test is completed the part can still be used. Test method names often refer to the type of penetrating medium or the equipment used to perform that test. Current NDT methods are: Acoustic Emission Testing (AE), Electromagnetic Testing (ET), Guided Wave Testing (GW), Ground Penetrating Radar (GPR), Laser Testing Methods (LM), Leak Testing (LT), Magnetic Flux Leakage (MFL), Microwave Testing, Liquid Penetrant Testing (PT), Magnetic Particle Testing (MT), Neutron Radiographic Testing (NR), Radiographic Testing (RT), Thermal/Infrared Testing (IR), Ultrasonic Testing (UT), Vibration Analysis (VA) and Visual Testing (VT). [12]An electromagnetic locator, or, pipe and cable locator, is used for tracing utility lines and metallic pipes, and clearing excavation and drilling locations. These utility locators consist of two main parts, a transmitter and a receiver. The transmitter emits a frequency selected by the operator that induces onto nearby pipes and cables. The receiver detects these radio frequencies, and the operator is able to accurately locate and trace the pipes and cables. Underground utility locating requires the use of a few different methods in order to accurately mark buried lines. The most common method to locate private utilities is known as electromagnetic utility

locating. In this technique the locating equipment generates an electromagnetic radio frequency and when applied to the ground, the subsurface utilities containing conductive material can be detected on a receiver. This method is very accurate and commonly used to detect gas, electric, telephone, cable, propane, water, sewer, storm and irrigation lines. The biggest limitation of this technology is that it cannot locate unmarked plastic, asbestos, concrete, tera-cotta or non-ductile pipes. [13]Induction is used when there is no surface access to the target line. Induction is the least desirable method of locating due to the massive amount of electromagnetic coupling, or bleed off that is created. Induction method, when used properly is an invaluable locate method. The transmitter is placed on the surface, and over the point where the target line is thought to run. Once the target line is located, it is then traced with the receiver using the same method as direct connection. This method can also be used to perform an inductive search to locate unknown or abandoned lines. [4]A locating sonde is used when there is surface access to a buried pipe, but the pipe is non-metallic and not capable of carrying an EM signal. The sonde is a beacon that radiates its own set frequency which can be traced by a receiver. Applications include empty conduits, drain and sewer lines. A Duct Rod is a flexible, detectable line that is pushed into drains, conduits and sewer lines which carries a signal from the transmitter using the direct connection method. The duct rod can be used together with a sonde attached to it. The sonde is pushed or pulled through the pipe, conduit or sewer line with a duct rod and then traced using the direct connection method. [10]Acoustic location is the science of using sound to determine the distance and direction of its source or reflector. Location can be done actively or passively, and can take place in gases (such as the atmosphere), liquids (such as water), and in solids (such as in the earth).

* Active acoustic location involves the creation of sound in order to produce an echo, which is then analyzed to determine the location of the object in question.
* Passive acoustic location involves the detection of sound or vibration created by the object being detected, which is then analyzed to determine the location of the object in question.

Both of these techniques, when used in water, are known as sonar; passive sonar and active sonar are both widely used. Acoustic mirrors and dishes, when using microphones, are a means of passive acoustic localization, but when using speakers are a means of active localization. Typically, more than one device is used, and the location is then triangulated between the several devices. [14]Ground penetrating radar or GPR is a technology used for subsurface utility locating which also uses high frequency pulses. The radio waves are emitted into the ground and facilities deflect the radio wave back up to the operator where the objects will be displayed on the equipment. This type of locating equipment is generally used for buried pipes, tanks, manholes, cables and other buried objects that cannot be located with other more common methods, such as electromagnetic locating. Operating this type of equipment and understanding the results require experience and extensive training. [11]Vacuum excavation is a fast and non-destructive way to safely locate and expose underground utilities. Here, high pressure air is used to break up the soil, which is then vacuumed into a tank. Hydro excavation is used in difficult soil conditions where pressurized water breaks up the soil which is then vacuumed into a tank. This is more commonly known as potholing, hydro-digging, hydro-trenching or soft digging. The basic components of a vacuum excavation system include a slurry or debris tank capable of storing spoils until they are discharged off-site; a suction hose and pump to vacuum spoils from the earth or from pits and reservoirs to a slurry tank; and an engine to power the system components. If the system includes hydro excavation capabilities, water tanks, pumps, water lines, and jetting tools such as wands and water lances are also needed. Hydro and/or compressed air jets and vacuums may be employed to remove debris, and clean clogged utilities. During preconstruction, vacuum excavation systems may pothole to expose existing utilities where use of mechanical excavators, backhoes or boring equipment could risk damage to utilities. During construction and post construction, vacuums may be used to remove spoils associated with directional drilling and tunnelling operations. In addition, vacuums are sometimes used to support hand tunnelling and auger boring operations where the vacuum hose is extended to the face of the tunnel to remove spoils from inside the casing.

II. RESEARCH METHODOLOGY

2.1 Metal detector

A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. Another common type are stationary "walk through" metal detectors used for security screening at access points in prisons, courthouses, and airports to detect concealed metal weapons on a person's body. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces a magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected. The first industrial metal detectors were developed in the 1960s and were used extensively for mineral prospecting and other industrial applications. Uses include detecting land mines, the detection of weapons such as knives and guns (especially in airportcurity), geophysical prospecting, archaeology and tre asure hunting. Metal detectors are also used to detect foreign bodies in food, and in the construction industry to detect steel reinforcing bars in concrete and pipes and wires buried in walls and floors

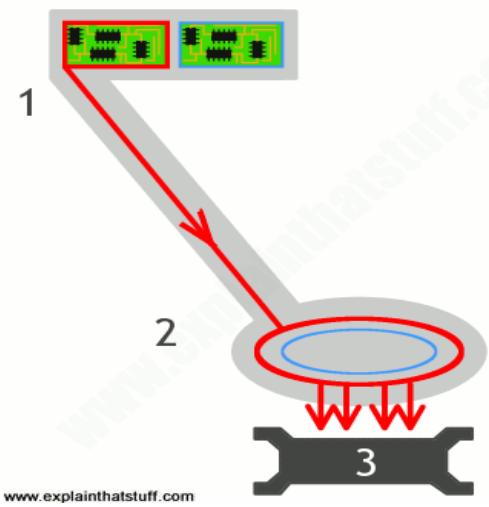

Figure.1. Metal detector

What make a metal detector buzz when you sweep it over buried treasure? Why is it important to keep the detector moving?

1. A battery in the top of the metal detector activates the transmitter circuit (red) that passes electricity down through a cable in the handle to the transmitter coil (red) at the bottom.
2. When electricity flows through the transmitter coil, it creates a magnetic field all around it.
3. If you sweep the detector above a metal object (such as this old gray spanner), the magnetic field penetrates right through it.
4. The magnetic field makes an electric current flow inside the metal object.
5. This flowing electric current creates another magnetic field all around the object. The magnetic field cuts through the receiver coil (blue) moving about up above it. The magnetic field makes electricity flow around the receiver coil and up into the receiver circuit (blue) at the top, making a loudspeaker buzz and alerting you you've found something.

2.2 Concrete block

Those that use cinders (fly ash or bottom ash) are called cinder blocks in Canada, the United States, and New Zealand, breeze blocks (breeze is a synonym of ash) in the United Kingdom and New Zealand, and hollow blocks in the Philippines. In Australia they are also known as Besser blocks or besser bricks, because the American-based Besser Company was a major supplier of concrete-block-making machinery. Clinker blocks use clinker as aggregate. In non-technical usage, the terms cinder block and breeze block are often generalized to cover all of these varieties.

Composition

Concrete blocks are made from cast concrete (e.g. Portland cement and aggregate, usually sand and fine gravel, for high-density blocks). Lower density blocks may use industrial wastes, such as fly ash or bottom ash, as an aggregate. Lightweight blocks can also be produced using autoclaved aerated concrete.

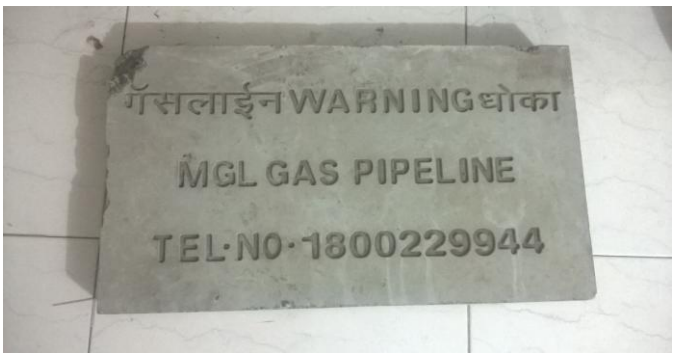

Figure.2. Cement Brick

2.3 Aluminium

Aluminium is a chemical element in the boron group with symbol Al and atomic number 13. It is a silvery-white, soft, nonmagnetic, ductile metal. By mass, aluminium makes up about 8% of the Earth's crust; it is the third most abundant element after oxygen and silicon and the most abundant metal in the crust, though it is less common in the mantle below. Aluminium metal is so chemically reactive that native specimens are rare and limited to extreme reducing environments. Instead, it is found combined in over 270 different minerals. The chief ore of aluminium is bauxite. Aluminium is remarkable for the metal's low density and its ability to resist corrosion through the phenomenon of passivation. Aluminium and its alloys are vital to the aerospace industry and important in transportation and building industries, such as building facades and window frames. The oxides and sulfates are the most useful compounds of aluminium. Despite its prevalence in the environment, no known form of life uses aluminium salts metabolically, but aluminium is well tolerated by plants and animals Because of these salts' abundance, the potential for a biological role for them is of continuing interest, and studies continue. Aluminium is used in different packing things also suck as pickles bottle, cold drinks, beverages, etc.

Reasons why aluminium used as tin can*:*

1. Aluminium is light.
2. Aluminium will not rust. Iron or steel will rust if it comes into contact with water and air. Most cans contain water so aluminium is quite appropriate.
3. It is easy to crush at garage sites.
4. It can be printed on easily.
5. Aluminium is a cheap metal. Can drinks are supposed to be cheap products.
6. It s easy to open as aluminium is light.
7. It can keep liquids for a long time without getting contaminated.
8. It does not flake off after been kept for a long time.
9. It can be kept safely outdoors.
10. It helps keep the liquid in cans cool.

IV. ANALYSIS & SUGGESTIONS

As describe about the structure and composition of concrete brick, similarly focusing on those points we are going to study or make the changes in the composition of the brick such that it could be detected without any excavation or any kind of geographical change. So we will change the content of the bricks, we will replace the material such as iron bars with aluminium, as aluminium could be detected easily using metal detector, detailed of metal are describe below:

Non-Ferrous metal is non-magnetic metals (copper, aluminum, brass, lead, etc.) It will take approximately 50% more of a non-ferrous metal to be as detectable as a ferrous metal. Manganese is also a non-ferrous metal and difficult for most metal detectors to detect. MDI's digital flat and surround systems are very effective in detecting manganese.

Generally Tin cans are used because they are easily available. Those cans which are trashed and thrown in dustbins, we can use them from there, or even from the dumping ground. Aluminium cans can be easily detected if they were buried, they sustain there upto 200-500 years, means its take 200-500 years to decompose an aluminium can. So even if it is buried in the bricks and placed below surface still it will be there for at least 200 years. It will take such a long time to decompose those bricks. So this project does the same as follows:

This study is using aluminium trashed cans in the bricks such that they will make structure from inside to hold the brick as the iron bars do. Aluminium is used instead because it is cheap and easily available compared to iron bars. A structure will be inserted in the brick such that it can be detected using a aluminium metal detector. Even if it is buried under the surface

yet it will give signals. So it will be easy to find out the bricks simultaneously it will locate pipes also.

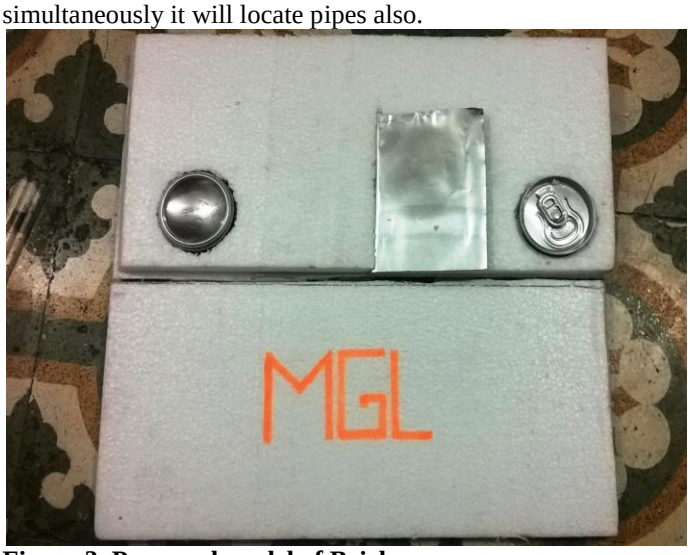

Figure.3. Prepared model of Brick

As shown in above figures, the structure of brick will be same and the main thing is to place the brick in an identical manner. The bricks will be placed alternatively after every two normal bricks such that when metal detector will be moved over the bricks, it will give signal after two alternative bricks so it will be identical and helpful to find the pipe. To keep these bricks in such a manner explains that when the metal detector is moved over the pipes even if any other aluminium thing may cause interruption, it will not divert the detector from the source line, means the LDPE pipes. Those will be easy to locate and reduce the time consumption which required to make pits and find the pipes.

V. CONCLUSION

As the objective and goal of the project is to locate buried pipes using method to replace the tiles with a new types of tiles, helps to obtain the goals which reduces cost and time. Even if there is a maintenance cost, the project work according to the plan and there is high reduction of cost consumption and exact location finding ability. As the procedure is mentioned, hence relating to that we can see that the change could do lots of things and could save money as well as time, and as mention in the objectives it conclude all the things, this idea has been shared with the operation & maintenance team of MGL, they are listened to these ideas and thought of working on it. A small model has been demonstrated on that which describes the whole idea. Due to such technique, there will be less impact on environment also it will be helpful for the company. Also the unnecessary costs that are incurred in digging are also reduced. This is a best solution to find the buried pipes, if properly implemented in the future. It will have a positive impact on the company and speed up the work and reduce the accidents and can save many lives.

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