DANUBE CROASING PIPELINE COMPLEX REHABILITATION SYSTEM PHYLOSOPHY

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REZUMAT. Lucrarea prezinta modul de reabilitare a conductelor de transport titei de la subtraversarea Dunarii. Sistemul de transport al titeiului din import are in zona Dunarii o subtraversare formata din 10 fire cu diametru de 12 ¾ inch. Sistemul este instalat in anul 1969 si nu a beneficiat de o intretinere si control de la darea in folosinta. Pornind de la riscul de poluare mare a Dunarii articolul de fata prezinta modul de reabilitare a acestui sistem.

Cuvinte cheie: Transport titei prin conducte, reabilitare conducte, subtraversare Dunăre.

ABSTRACT. This paper present the rehabilitation of the oil pipeline phylosophy, for the Danube Crossing Pipeline. Imported oil is transporting by pipeline by Constanta Harbor to the different refineries throughout the country.In Cernavoda Area Imported oil pipeline System crossing Danube by the complex of 10 pipelines of 12 ¾ inch diameter. The system was installed in 1969. After installation the system was not submitted to any special inspection and corrosion cracking study. As a consequence, risk of pollution Danube River is now very high. This paper preseted a complex rehabilitation program.

Keywords: Oil pipeline, pileine rehabilitation, croasing Danube.

1.INTRODUCTION

In 1967, Romania decides to ensure energetic independence by importing crude oil from Iran. Pipeline transportation of crude oil which provides port Constanta to Pitesti refinery was built from steel X 52 and 14 inch diameter. In 1974 it installs a second 20 inch pipeline and in 1979 mounted the third pipeline 28 inch.

This system of transport of oil ensure a capacity of over 20 million tons annually

Turkey's political problems (the possibility that the transport of petroleum products through the Bosphorus Strait to be stopped), and especially low price of oil makes the extraction of crude oil from Romania not to be profitable. Romania extracts approximately 5 million tonnes oil but necesarry of finished products is located somewhere at 10 million tonnes.

In this case the import of crude oil processing has become vital for Romania and for surrounding countries (the EU wishing to achieve a system of interconnecting pipelines shipping crude in Europe).

The age of the crude oil transport system (over 50 years) as well as the necessity of permanent operation, maintain requires engineers a rehabilitation program.

This paper proposes a model of rehabilitation oil pipeline croasing of the Danube (the most delicate ecological route piping crude oil transportation).

2. OIL PIPELINE DANUBE CROASING REHABILITATION PHYLOSOPY

Because the system is based on transporting the oil from import to Romanian Refinery every day, possibility to long time shut down and rehabilitation of some parts of this system is very difficult and not favorable to contract partner. In this case I am proposed to rehabilitation (hot rehabilitation) of the system in function.

The component parts of this program are:

– comput the risk in exploitation;

– coating defect detection in soil river area;

– internal pigging calibration;

– internal corrosion detection;

– diver inspection to visualize integrity of the concret coating pipe;

– reducing pipeline pressure based to ANSI / ASME B 31 G criteria calculation for corroded line pipes;

– coating replacement;

– Chatodic Protection System rehabilitation;

– system hydrostatic testing for revalidation;

– writing pipelines revalidation documentation and presenting it to the Governmental Agency to approve new system pipeline working condition;

– abandonment of the corroded pipe;

– horizontal drilling for the new pipe.

3. DATABASE

The Danube Crossing Pipeline is placed to the Km. 276+100 according to the Navigation Chart to the Danube. These pipes have been fitted through the process of dredging the bottom of the Danube and then their Groove dredge.

The pipeline to be rehabilitated has the following properties:

– Number of line = 10 (ten);
– Outside diameter = 12 ¾ inch;
– Wall thickness = 14 mm.;
– Standard = GOST 8731-58;
– Material = ST 3;
– Immersed pipes;
– Average length = 2 km.;
– Fittings = Regular Gate Valves ;
– Bends = forged minimum 3D;
– Coating External = Asphalt Bitumen + Fiber Glass Inner Wrap + PVC Outer Wrap + Concrete Coating.

There is magnetic content in the concrete coating.

– Age = up to 47 years.;
– Flow condition = crude oil;
– Temperature = 2 ... 30 ^{o}C;
– Wax Content = 5 ... 12 % weight;
– Pressure = maximum 64 bar.

3. COMPUTED RISK IN EXPLOITATION

The probability of a spill occurring along a pipeline lies at the core of risk management for pipeline operator.

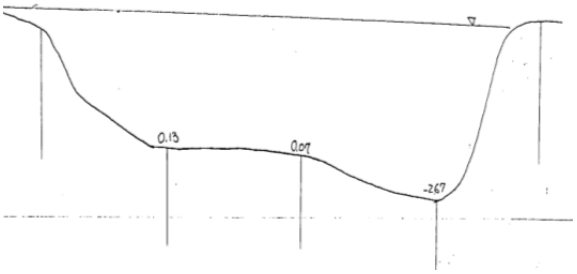

Fig. 1. Oil Pipeline Danube Profile.

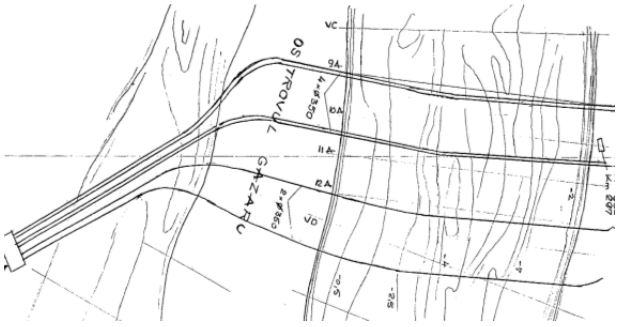

Fig. 2. Oil Pipeline Danube Location.

Photo 1. Danube croasing pipeline install.

Photo 2. Oil Pipeline Install.

Photo 3. Mount on the bottom of the pipe.

Photo 4. Dregging of the Dabube botton .

I proposed a methodology to risk evaluation based to the formula:

Risk = frecvency (number of accident per year)* vulnerability (environment and population) *consequences (deads or tones per event).

4. COATING DEFECT DETECTION

The coating defect detection is conceived as an above ground survey coating defects technique performed at close interval, able to provide relevant information about coating defect location, size, importance and character (corrosive or non corrosive). The test will be applied on the entire pipeline length to avoid any possibility to miss the detecting of any small but corrosive defect, impossible to detect by long interval test method.

Defect prioritization will be done by using recognized and recommended measurement and calculated values, using scales recognized by international practice.

Wherever the existing protection system is inadequate for the test performance, temporary chatodic protectuon station will be installed.

All pertinent data will be done as line graph:

– ON and OFF potential;
– On and OFF voltage to remote earth;
– % protection pipe drops;
– pipeline burial depth;
– depolarization gradient.

5. INTERNAL DEFECT DETECTION

I decided to use intelligent inspection tools based on the principle of magnetic flux leakage useful in the detection of pipeline corrosion.

Before to Internal Corrosion Detection has been carried out a calibration program by using aluminum gauge plates, attached to bi-di high density polyurethane cleaning pigs.

6. REDUCING PIPELINE PRESSURE BASED TO ANSI/ ASME B31G CRITERIA CALCULATION FOR CORRODED PIPES LINE

After running the inspection tools I decided to reduce pipeline pressure based to ANSI/ASME B 31G.

ASME B31.4 and B31 G code are procedures for analyzing flow in pipe and for repairing them.

Both codes also provide analysis of interconnected pitting, taking into account the longitudinal length of these pitted areas. A given corroded region in a pipeline is evaluated on the basis of its maximum length (L) and maximum depth (c).

Sound engineering judgement requires that corrosion should not be allowed to reach a size (L and c) so large that the predicted failure stress level is at or below the maximum operating stress. Therefore a factor or safety was applied.

Above philosophy in conjunction with calculation programmed were developed in order to cover needs (proving result listing and graphs) for each type and size of pipe.

The use of graphs (or result listing) is an effective and easy way for pipe line inspectors to determine the extent of external corrosion zones that require repair, replacement or/and compute the derated operating pressure.

Computer program was validated by hand calculations.

7. COATING REPLACEMENT

Criteria for coating replacement decision are based on AGS survey results. The coating of line section with more that 40 defect/km will be repair and for the rest of sections te defects will be covered by cathodic protection.

8. SYSTEM HYDROSTATIC TESTING FOR REVALIDATION

The Government Agency decides to Approval function of the Pipeline Company based of the result of hydrostatic testing of the pipeline system.

The hydrostatic testing is realized in every pipe. Before to Pipeline hydrostating testing is necessary to dewatering, cleaning and drying of the pipe.

9. WRITING PIPELINE REVALIDATION DOCUMENTATION AND PRESENTED TO THE GOVERNMENTAL AGENCY TO APPROVE NEW SYSTEM PIPELINE WORKING CONDITION

Documentation necessary for the Governmental Agency is:

– hydrostating test resulting.
– new gis information.
– modification of the pipe system.

In accordance with Romanian Law, Agency decides to operating system or application on new rehabilitation procedures.

10. CONCLUSION

This paper presented a strategy of the oil pipeline rehabilitation.

The component parts of this program are:

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