

April 25, 1984

Tenneco Oil Company
P. O. Box 849
Pasadena, Texas 77501-0849

Attention: Mr. Paul R. Prokish

Reference: Cathodic Protection Survey of Pasadena Plant and Off-Site
Pipelines - Contract number 90-2945, P. O. #138653-01A

Dear Mr. Prokish:

A cathodic protection survey of the above referenced facilities was completed on March 21, 1984. This survey was conducted to determine the effectiveness of the cathodic protection system for the plants underground metallic structures and off-site pipelines.

Survey Procedures

Pipe-to-soil potentials were measured at random test points throughout the plant. The test point locations can be seen on Tenneco drawings number C-TM1-200-P-112 and C-PC1-P-01-353. These potential measurements were taken using a high impedance voltmeter in conjunction with a standard copper-copper sulphate reference electrode. The rectifiers were inspected and the voltage and amperage output was measured. Anode current output for each anode in the deep well groundbeds was recorded. Pipe-to-soil potentials and magnesium anode current output were taken at test stations for the off-site pipelines. Data pertaining to this survey can be seen on the attached data sheets.

Survey Results

One criteria for effective cathodic protection is a minimum of -0.85 volts DC. This measurement is taken between a standard copper-copper sulphate reference electrode and the pipeline. Potential measurements in the P.A. unit area were below acceptable levels. The current output for rectifiers "A" and "B" were increased to their maximum output after low potentials were discovered in this area. After the rectifiers' output was increased, potential measurements were repeated. Pipe-to-soil potentials did increase, but did not increase above the required -0.85 volts.

Rectifier "C" has an internal intermittent electrical short. During this survey the rectifier was operating satisfactorily. After the survey was

7 PERIMETER PARK DRIVE
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Mr. Paul R. Prokish
April 25, 1984
Page two

completed the rectifier was taken out of service, repaired and returned to service.

Rectifier "A" was found to have no current output at the beginning of the survey. The problem was investigated and found to be a loose connection for the positive cable in the anode junction box. This connection was repaired and the rectifier is operating correctly.

Rectifier "D" was found to have a damaged anode junction box. The rectifier and anodes are operating satisfactorily, but the box should be repaired or replaced.

Over all the pipe-to-soil potential measurements were above the -0.85 volts required for cathodic protection except in the area of the P.A. unit.

Pipe-to-soil potential measurements were taken at random test stations for the off-site acetylene, hydrogen, AOG and VCM pipelines. All potentials recorded were above the criteria for cathodic protection.

Recommendations

It is recommended that a new groundbed and rectifier be installed in the area of the P.A. unit. The system recommended would be similar to the existing systems. The groundbed would be a 8" x 200' hole with 18 Durichlor 51 type "M" anodes. Metallurgical coke breeze would be pumped around the anodes. The anode lead wires would be terminated in a junction box with current measuring shunts. A Universal 45 volts, 60 amp air cooled rectifier would be installed on a pole near the groundbed location. The AC power required for the rectifier would be 480 volts, 3 phase.

It is also recommended that the anode junction box for rectifier "D" be repaired or replaced.

Some test points shown on drawing number C-PC1-P-01-353 are located a few feet from each other. It is recommended that if two test points are located in close proximity, that one be omitted. Test point number 12 is on the dock above the water line and therefore, should be omitted.

We recommend that you continue to check the rectifiers on a monthly basis and have a complete plant survey yearly.

General Cathodic Protection Services, Inc., would be pleased to install the recommended groundbed and rectifier for a turnkey price of \$12,351.00. The AC power to the rectifier would be the responsibility of Tenneco. This price is valid for a period to 90 days.

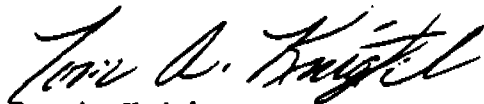
Mr. Paul R. Prokish
April 25, 1984
Page three

Enclosed is our invoice number 01-TX-25037F in the amount of \$1,492.00 to cover the cost of this survey and rectifier repairs.

We appreciate this opportunity to have been of service to your company.

Very truly yours,

General Cathodic Protection Services, Inc.



Tom A. Knight

TAK/afm