US Army Corps of Engineers, Anchorage

CORROSION STUDIES

DEZADEASH LAKE AREA

HAINES - FAIRBANKS POL

MAY 1968

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PREFACE

The investigation reported herein was authorized by Directive No. NPD 8, Fort Richardson 1968 O&M, dated 22 May 1968.

Field studies for this report were conducted by personnel from the Corps of Engineers District Laboratory during the period 24 - 29 May 1968. Instructions for the field studies were contained in EM 1110-1-184 and in directive Inter-Army Order for Reimbursable Services, Form DA 2544, dated 21 May 1968.

SUMMARY

The area inspected on the POL line from Haines to Fairbanks was primarily in the Dezadeash Lake region between pipeline Milepost 114 and Milepost 127. The primary area of concern was located at pipeline Milepost 119.1 where concentrated corrosion perforated the line. Approximately 550 feet of line adjacent to the perforation showed extreme pitting due to unfavorable soil conditions. Soil testing in areas adjacent to the break that were not uncovered during this inspection were not conducted due to the extremely low temperature condition of the soil. Much of the soil existed in a frozen state. Damage observed was generally attributed to dissimilar soil conditions.

HISTORY

1. The Haines-Fairbanks Pipeline was constructed during the period from 1953 through 1955 under Contract DA 573 by Williams Brothers - MacLaughlin & Morwell under the supervision of the Corps of Engineers. The line is eight inches in diameter and runs through Canada and Alaska from Haines to Eielson AFB (Fairbanks). None of the line received any protection in the form of surface coatings other than factory applied pipe varnish. Three areas in the vicinity of Slims River and Kluane Lake have been protected with magnesium anodes.

2. The recent break at Milepost 119.1 in the Dezadeash area is the second line penetration from natural causes since the line went into operation. The first penetration occurred above Haines in 1965.

3. No major maintenance of the POL line to prevent loss of metal due to corrosion has been accomplished, nor has the entire POL line been examined for unfavorable soil conditions.

INVESTIGATIONAL PROCEDURES

4. Testing in accordance with EM 1110-1-184 was conducted in the vicinity of the pipe perforation at Milepost 119.1. Limited testing was accomplished as generally frozen conditions still existed in the soils above the pipeline. Soil conditions and surface laid pipe conditions were observed in the area from Milepost 114

to Milepost 127. Pipe to soil potentials were secured in thawed soils adjacent to the perforation as were resistivity readings in the conductive materials adjacent to the perforation.

INSPECTION RESULTS

5. The area of high corrosion is located from approximately pipeline Milepost 119 to Milepost 119.1.

6. Resistivity tests of muskeg at approximately Milepost 119.12 range from 25,600 Ohms-cm to 38,400 Ohms-cm corrected to 60°F covering average depths of three to five feet and based on a soil temperature of 32°F. This temperature is not considered reliable for the full depth tested but does not indicate an excessively corrosive environment. Tests in the clay adjacent to the line perforation ranged from 7,000 to 7,400 Ohms-cm corrected to 60°F. EM 1110-1-184 classes this resistivity reading as medium with anticipated moderate corrosion activity.

7. Generally, corrosion in this area may be attributed to differential soil environmental conditions. When the installed pipeline is in contact with an electrolyte having an extremely variable composition from one point of contact to another corrosion will occur. From the tests conducted, it appears that the current being discharged to the soil at the point where it leaves the pipe surface is in the neighborhood of 0.15 M-Ohms at 0.42 Volts. A typical example of this type of activity is shown on Plate I.

Small corrosion cells develop between that portion of the exposed pipeline adjacent to fine grained materials (clay) and that portion of the pipeline adjacent to high resistant type materials (muskeg) shown on Plate II. Normally, if a pipeline is completely exposed in soils having resistivities as high as were encountered at Dezadeash, and the soil adjacent to the pipe is uniform, little or no detrimental corrosion will occur. The pipeline examined at the break area was partially coated with factory applied varnish and was buried in a variety of soils with concentrated corrosion taking place in holiday areas typical of pitting shown on Plate III.

8. Between Mileposts 115 and 119 two areas were flagged for digging bell holes and checking the condition of the pipe. The soil in these particular bogs appeared to be clay and the field on each side of the bog appeared to be gravel. Corrosion could be taking place in the area flagged due to dissimilar soils surrounding the pipeline.

9. Generally, where the pipeline was laying on top of the muskeg, little or no loss of metal was observed. Shallow pitting that is not considered serious was observed 400 feet north of the creek crossing at pipeline Milepost 125.2. This pitting was observed at the stream paralleling and adjacent to the pipeline for a distance of approximately 100 feet. At pipeline Milepost 126.96 the entire line was submerged in stagnant water and appeared exceedingly yellow with rust. This section of the line should be re-examined

after it is completely thawed and drained.

RECOMMENDATION

10. After the soil is completely thawed in the Dezadeash Lake area and it is possible to insert temperature probes and resistivity probes to the depth of the pipe, the entire area should be resurveyed to outline areas requiring protection.

11. In the event the section of pipe replaced at Lake Dezadeash is buried cathodic protection in the form of anode beds such as exist at Lake Kluane should be installed. Corrosion of the new pipe without any protection will be relatively rapid (expected life - 6 years) due to the variation in metallic composition between the original British manufactured steel and the new line installed.

12. Sleeves of polyethylene such as described in Plate IV (an excerpt from a report on corrosion by W. Harry Smith, Assistant Managing Director for the Cast Iron Research Association) should be secured for protecting replaced pipe during general maintenance of the POL system.

LABORATORY ANALYSES

13. Additional information in the way of soils and water analyses will be supplied upon completion as an addendum to this report.