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Subject: Inspection of Oil Sales Lines
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As previously discussed, the Corrosion Group recommends smart pig inspections of the oil sales lines from Flow Station 2 to Flow Station 1 and from Flow Station 1 to Skid 50. A discussion of this recommendation, an alternative and the advantages and disadvantages of each follows.

Background

Sales oil flows from FS 2 through a 30" pipeline (15,794' long) to Module 4922 at FS 1, where it is commingled with oil from FS 1. The combined stream is transported through a 34" line (25,996' long) to Skid 50 and then to Pump Station 1. Production from FS 3 goes through a 30" line which feeds into the 34" line near FS 3. The normal operating temperature of the lines is about 115 degrees F., although they have been operated in the 140 degree range in the past.

To date, only minimal monitoring and inspection data has been gathered on the lines. A coupon location has been added to the FS 2 line at FS 1's Module 4922. This location has been pulled only two times. The first pull, from the fourth quarter of 1989, was graded "D" due to a single pit in one of the coupons which may have been mechanical in origin. The coupons from the first quarter of 1990 were graded "A". No organic deposits, such as paraffin, were on the coupons. Coupon locations will be added to the FS 1 and FS 3 lines and the main line outside of Skid 50 as soon as operationally feasible. Only about 115 square feet of piping at the 4922 modules and Skid 50 has been inspected with automated UT (C-scan); no corrosion indications were identified. The lines are insulated with GE insulation, which is scheduled to be replaced this year due to external corrosion concerns.

Because of the low water content of the crude in the sales lines (the spec is 0.35%), significant internal corrosion is not expected. To our knowledge, none has been detected by the smart pig inspections performed to date in the TAPS line. On the other hand, severe corrosion has been experienced in the uninhibited flowlines and tubing strings of wells making only trace amounts of water early in the life of the field. If the water in the sales line segregates and flows along the bottom of the line, there is the potential for bacterial or underdeposit corrosion, which could result in scattered pitting, or carbonic acid attack, which could lead to a more continuous channelling type of damage. In either case, the most severe damage would be expected at bottom dead center of the lines.

There are two proven inspection methods which could be used on the sales lines: smart pigging and C-scan. The other option, of course, is to do no inspection. The Corrosion Group believes that the "do nothing" option is not prudent. The inspection options are discussed below.

Smart Pigging - (Recommended)

Smart pigging would involve running a series of cleaning pigs and the inspection pigs through the lines from FS 2 to FS 1 and from FS 1 to Skid 50. As far as we know, the lines have not been pigged since field start-up. Tentative plans have been made to run the Pipetronix smart pig in October, 1990. Preliminary cleaning and gauge pigs could be run as soon as operationally feasible.

Advantages

- **Comprehensive inspection:** The smart pig inspection would yield information about the entire circumference of the line, from the launcher to the receiver. It would locate external as well as internal corrosion. However, because the insulation on the sales lines is to be reconditioned this year, external corrosion should not be an issue. In addition, future repeat inspections would be relatively simple to perform.
- **Production impact:** Since the entire operation can be done on line, no reduction in production rates is necessary.
- **Cost:** The estimated cost of the entire smart pigging operation for both lines, including support labor and cleaning runs, is about \$150,000.

Disadvantages

- **Risk of sticking:** Although the risk of sticking either a cleaning pig or an inspection pig is very low, we acknowledge that the cost of such a mishap would be quite high. The chance of an incident can be minimized by planning thoroughly and following a carefully developed procedure. The Corrosion Group is developing a detailed procedure for preparing the lines and running the smart pigs. In addition, a contingency plan will be developed to minimize the down time in the event that a pig does get stuck.

Automated UT - (Second choice)

If the C-scan UT method of inspection were to be employed on the sales lines, the scanning would probably be limited to the bottom 6" or 12" of the line. We would recommend scanning all accessible areas of the lines. As discussed above, if there is significant internal corrosion in the lines, it is most likely to occur at bottom dead center. The lines will be stripped of insulation later in the summer; this provides an opportunity to perform a C-scan inspection without the incremental cost of insulation removal.

Advantages

- **No production impact or risk of sticking:** C-scan can be performed on the lines while in service. Of course, there is no risk of getting anything stuck or lost in the line when using an external NDT device.

Disadvantages

- **More expensive:** If a one foot wide strip of pipe is C-scanned, the cost of inspection would probably be about \$30 per linear foot. Scanning all accessible areas of the lines would cost about \$1,065,000.
- **Less comprehensive:** The proposed C-scan inspection would yield no information concerning the existence of corrosion or defects anywhere away from the bottom of the

lines. A 12-inch wide scan would give us 11% radial coverage on the 34-inch line and 13% on the 30-inch line. Saddle areas, anchor blocks and eleven road and caribou crossings would not be inspected, further reducing our confidence in finding corrosion. The road and caribou crossings are of particular concern, as there are currently no plans to replace the GE insulation in these areas.

- Recurring inspections more difficult: After the insulation is reconditioned, any external NDT method becomes much more difficult. Any repeat scans would involve stripping the new insulation, coating and tape wrap, which would be considerably more expensive.

Summary

The Corrosion Group recommends smart pigging the sales lines because it is a reliable, comprehensive inspection method. We believe the risk of encountering significant operational difficulties is small. The alternative, C-scanning the bottom of the accessible areas of the lines, is a viable alternative. However, it is considerably more expensive than smart pigging. The proposed C-scan inspection would give us a lower confidence in finding corrosion or defects because we would not be inspecting the road crossings, anchor blocks and saddle areas and because radial coverage is limited. Since very little monitoring or inspection has been done on these lines in the past, we strongly recommend against doing no inspection.

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