

Mitigating Internal Corrosion in Coiled Tubing

Internal corrosion is one of the most prevalent causes of premature failure in used coiled tubing. To reduce the incidence of failures and prolong the life of the tubing, regular cleaning and treatment of the string with the appropriate combination of wiper balls, wire brush pigs, biocides, inhibitors, and high-quality nitrogen is needed to store strings between jobs. The following procedure outlines the general steps for mechanically cleaning and inhibiting coiled tubing.

1. Attach pig / ball catcher to the outside pigtail (field pig catcher design will vary).



2. Knock off the 1502 plug.



3. Insert the brush pig.



4. Insert the foam ball.



5. Push the ball and pig past the port in the tee and reconnect the cap.



6. Attach inhibitor fill line, then pump desired volume of mixture.
7. After inhibitor mixture is injected, remove all pressure on reel plumbing/manifold.



8. Knock off the 1502 plug.
9. Insert second foam ball and push past tee and replace cap.



10. Attach the nitrogen line to the reel manifold.



11. Make sure all valves are open for the path of the nitrogen then turn on nitrogen to begin the pigging process.
12. After blow down, bleed off all nitrogen before removing any lines or pig/ball catcher. Verify both brush pig and ball are received in catcher.

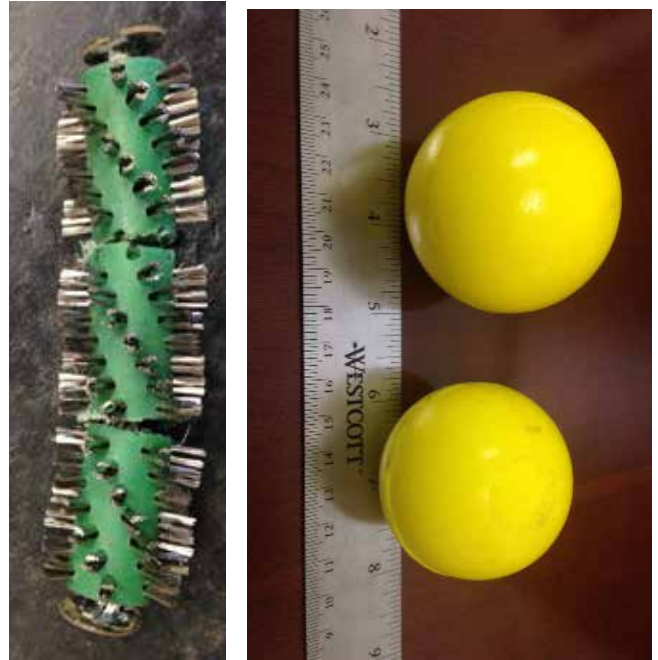


► Procedure Timeline Example

- 00:00 min: Filling process complete (CT full of water).
- **00:04 min: Brush pig and foam ball inserted.**
- **00:09 min: Pump in Biocide/inhibitor mixture.**
- **00:10 min: Insert foam ball.**
- **00:12 min: Nitrogen turned on.**
- 00:42 min: Nitrogen turned off and verified retrieval of brush pig and foam balls.

BOLD font indicates time added to normal operations

► Sample Materials



The brush pig should be sized properly for each CT OD size. The hard core should fit the minimum ID of the tubing, while the bristles should be sized for maximum ID in the tubing.

The urethane foam wiper balls feature a medium-hard density, but are compressive under pressure, resulting in better wiping performance from fewer size variations. The foam ball should be sized to match the ID of the tube.

- Short times between jobs-even as short as 8 hours have shown to have enough time to establish scale on the surface where the bacteria is insulated from future chemical treatments.
- Purging and capping with nitrogen only does not always protect the pipe.
- Typically, 3 bbl of fluids are left in strings returned from the field. It is likely MORE fluids are left in the strings between jobs.
- Mechanical pigging is necessary to break up the biofilm membrane and expose it to future chemical treatments.
- Frequent pigging of the coil will reduce scale buildup and limit ponding corrosion
- A slug of inhibitor is used after wire brushing. Biocides are typically used to treat the water and assure Microbiologically Induced Corrosion is not initiated. Both the treatment of the string with inhibitors and treatment of the water with biocides is important for short and long term storage and string longevity.

► **Pigging results and ID surface improvement**

Close up of the internal surface of the CT prior to pigging, with considerable amounts of scale and rust present.



Note the spiral brush pig is on the left center.



Close up of the internal surface after pigging with the scale removed, reducing the occurrence of corrosion pitting beneath the scale.



Note small colonies of corrosion with preferential pitting are reveal after pigging. Frequent removal of scale will reduce the amount of localized bacteria growth.

- ▶ Examples of ponding type corrosion are shown below where residual fluids settle out in the bottom wraps of the stored coiled tubing between jobs. Carefully following pigging/inhibition/drying procedures can eliminate this type of damage.

