



## Declining throughput: a continuum of challenges

The trans-Alaska pipeline transformed Alaska's economy and strengthened the nation's energy infrastructure. The pipeline today transports some 11 percent of the nation's domestic crude production and remains the backbone of Alaska's economy, delivering about 90 percent of unrestricted general fund revenue.

More than 2 million barrels a day (BPD) once surged through the Trans Alaska Pipeline Systems (TAPS). Since peak flow in the late 1980s, TAPS throughput has dropped. Today it is declining more than 5 percent per year. Less oil means slower-moving oil. Slower oil means colder oil. And the slower and colder the oil, the more complicated the challenges for Alyeska Pipeline Service Company, the pipeline's operator.

The best long-term solution is more oil. In the meantime, daily throughput is already lower than it was at pipeline startup in 1977.

### Water/ice

Crude oil naturally contains small amounts of water. As crude slows and cools, water will begin to separate out from the oil and accumulate at the bottom of the pipeline, increasing the risk of corrosion. This happens today during shutdowns, when water accumulates at low points. As water drops out and everything cools, the risk of ice-related problems also increases.

### Wax

ANS Crude oil naturally contains up to 2 percent wax by volume. There are two issues with wax: First, when the pipe walls are colder than 70 degrees and colder than the oil, wax crystals gravitate to the pipe wall and stick to it. Second, wax precipitates out of the crude oil. Less turbulence, cooler crude temperature and slower flow all may result in more wax sticking to pipe walls and more wax dropping out of the oil and settling in the pipeline. Wax deposits must be removed by running cleaning pigs.



### Less throughput = more challenges

Less oil → slower flow → crude spends more time in pipe, and less turbulence  
Slower flow/less turbulence → more wax may accumulate in the pipe, requiring more frequent 'pig' cleaning  
More time in pipe → Crude loses heat → higher risk of ice problems, more wax forms

- TAPS is currently moving an average of 548,000 BPD (2012 daily average)
- Challenges are immediate
- No hard and fast thresholds; a continuum of challenges requires corresponding actions to address them
- Ultimately may need shift to intermittent flow



## The pipeline today

Alyeska and its owner companies have analyzed the risks, options and challenges of declining throughput. Some mitigations are already in place, while engineers are validating other potential steps through laboratory and field tests.

### Transitional fix: more heat, more pigs

For the immediate future, Alyeska is adding heat to keep the crude warm and to prevent small amounts of water from freezing in the line. The cleaning pig program has been modified – with frequent pigging and redesigned pigs as needed – to keep the pipe clean of wax.

Heat is added through recirculation at Pump Stations 3, 4 and 9. Pump Station 7, which was previously decommissioned, is now back online to recirculate oil. Infrastructure for recirculating oil at that station is also enhanced. A schedule is in place for adding more heat as the crude continues to cool due to declining throughput.

### Longer term: cold dry flow

As throughput further declines, continuing to add ever more heat would create new problems. At some point – teams are researching this now – it appears the most effective approach will be to operate the line in a “cold-dry flow” state.

With cold-dry flow, most of the water is removed from the crude before it enters the pipeline and the system runs much cooler. Since the purpose of heat is mainly to prevent ice formation, eliminating most of the water eliminates the need for elaborate heating systems.

Once the cold dry flow system has been validated through field and laboratory testing, a transition phase will shift the system from heat-dependent operations to cold-dry flow.

Work is in progress to determine how best to manage wax accumulation.

