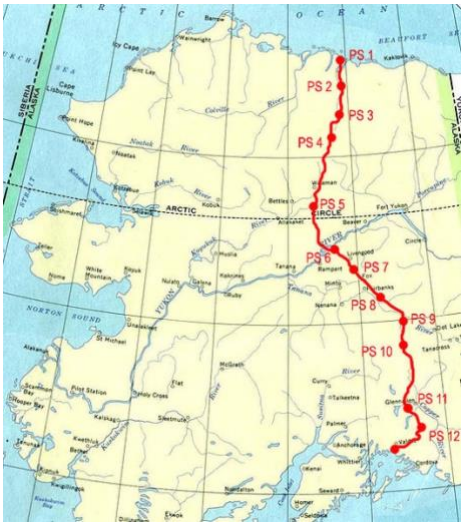
Mass & Energy Balances Homework Problem
Trans-Alaskan Oil Pipeline



The trans-Alaskan crude oil pipeline was constructed in the mid 1970's and pumps up to 2 MMbbl per day.

a) Convert 2 MMbbl per day to m^3/s. You may need to look up units.

b) The pipeline is 1.2m in diameter. What is the approximate velocity of the crude oil within the pipeline when flowing at maximum capacity?

c) The total pipeline is approximately 1200 km long. The starting station and the end terminal are both at approximately sea level, at nominal atmospheric pressure, and the oil is discharged into large tanks such that the velocity is near zero. Friction is calculated as F = k*L, where k is approximately $2.2x10^{-3}$ J/kg/m and L is the pipeline length in meters. What is the approximate shaft work required to pump the crude oil? List any needed assumptions about the properties of crude oil.

d) As we have discussed in class, an analysis of a chemical process (e.g. the title of this class!) should combine technical, economic, social/cultural, and safety/environmental considerations. Parts a-c address the technical feasibility of this chemical process. Brainstorm then list at least three social/cultural (ie specific groups of people) or safety/environmental aspects that must be considered in a project like this. You are welcome to provide many more. I will collect all constructive responses anonymously on the course discussion board for a followup conversation.

e) This pipeline was constructed, but in recent years, some other pipelines have not been constructed or given permits. Look, for example, at the Keystone XL pipeline. Provide a 1-paragraph summary on why this pipeline was not constructed. The BBC has a simple primer: https://www.bbc.com/news/world-us-canada-30103078