

**SEATTLE CHEMICAL INDUSTRIES
ENGINEERING DEVELOPMENT LABORATORY
SEATTLE, WASHINGTON 98195**

TO: Team C
FROM: Engineering Management
SUBJECT: Gas Flow Measurement

An ethylene oxide plant has requested that our laboratory evaluate methods for measuring gas flow rates. These measurements are essential for control of reactor recycle and purge streams. The process engineer has requested a comparison of a Venturi, orifice, Pitot, and thermal mass flow meter. Our technicians have already installed examples of these devices in our lab. Contrary to common practice, however, the thermal mass flow meter heats the entire gas stream; there is no bypass.

Some characteristics important to the plant are:

- 1) Low operating costs.
- 2) Fast response time.
- 3) Ability to monitor online in real time.
- 4) Accurate over extended periods of time.
- 5) High precision.
- 6) Signal to Noise ratio.
- 7) Low installation cost.

Please do a comparative study of the four meters, using the orifice meter as the standard for measuring flow rates.

We are particularly interested in the relative accuracy of each meter. Is there a significant deviation from the standard at a given Reynolds number? Does this depend on the Reynolds number at which the meters are operating? Can differences be eliminated by calibration?