Air Products Corporation supplies "merchant" hydrogen to a number of industrial locations in the United States. This hydrogen is produced in purpose-built plants employing steam methane reforming to produce the hydrogen. Some of these locations use a natural gas feedstock imported from Canada.

The Canadian government is looking at requiring hydrogen to be added to merchant natural gas to reduce the amount of carbon burned to when the gas is combusted. Air Products would like to know what effect this might have on their impacted facilities if such a procedure is implemented.

Steam methane reforming is a very endothermic process and the first step of the conversion takes place in a specialized reaction system which consists of long vertical catalyst filled tubes suspended in a high temperature flame environment in a reaction furnace. About two thirds of the natural gas processed goes to feedstock and one third goes to furnace fuel.

Adding hydrogen to the natural gas will impact what happens both in the catalyst filled tubes and in the downstream part of process, plus the operating characteristics of the reaction furnace.

Our job will be to assess all potential impacts both process and reaction furnace related, and to describe these impacts in an aide memoire to Air Products. We should particularly be looking for whether there is a hydrogen inclusion break point at which serious modification to the facilities might be required.

Air Products will provide us with typical natural gas compositions and the range of hydrogen inclusion to investigate. They will also provide an process flow diagram with anchor point temperatures, pressures and compositions to provide a starting point for our modeling effort. Equipment information as necessary will be provided upon request.

The first part of the project will be conducted in the Fall semester and will involve developing a work break down structure and a project execution plan including a schedule to show deliverable dates and dates for consultation with Air Products. Building and validating an XL thermodynamic model spread sheet to test the impact of different hydrogen compositions on reactor performance and an ASPEN process model will be the main deliverables for the Fall Term. Work in the Spring semester will involve evaluating all of the processing steps downstream of the reaction furnace for selected operating cases defined by the first semester's work.

A draft final report should be ready to be discussed with Air Products by April 15. A final report is due by early May.